2-m FM HANDHELD TRANSCEIVER

TH-25A/AT/E

SERVICE MANUAL

KENWOOD

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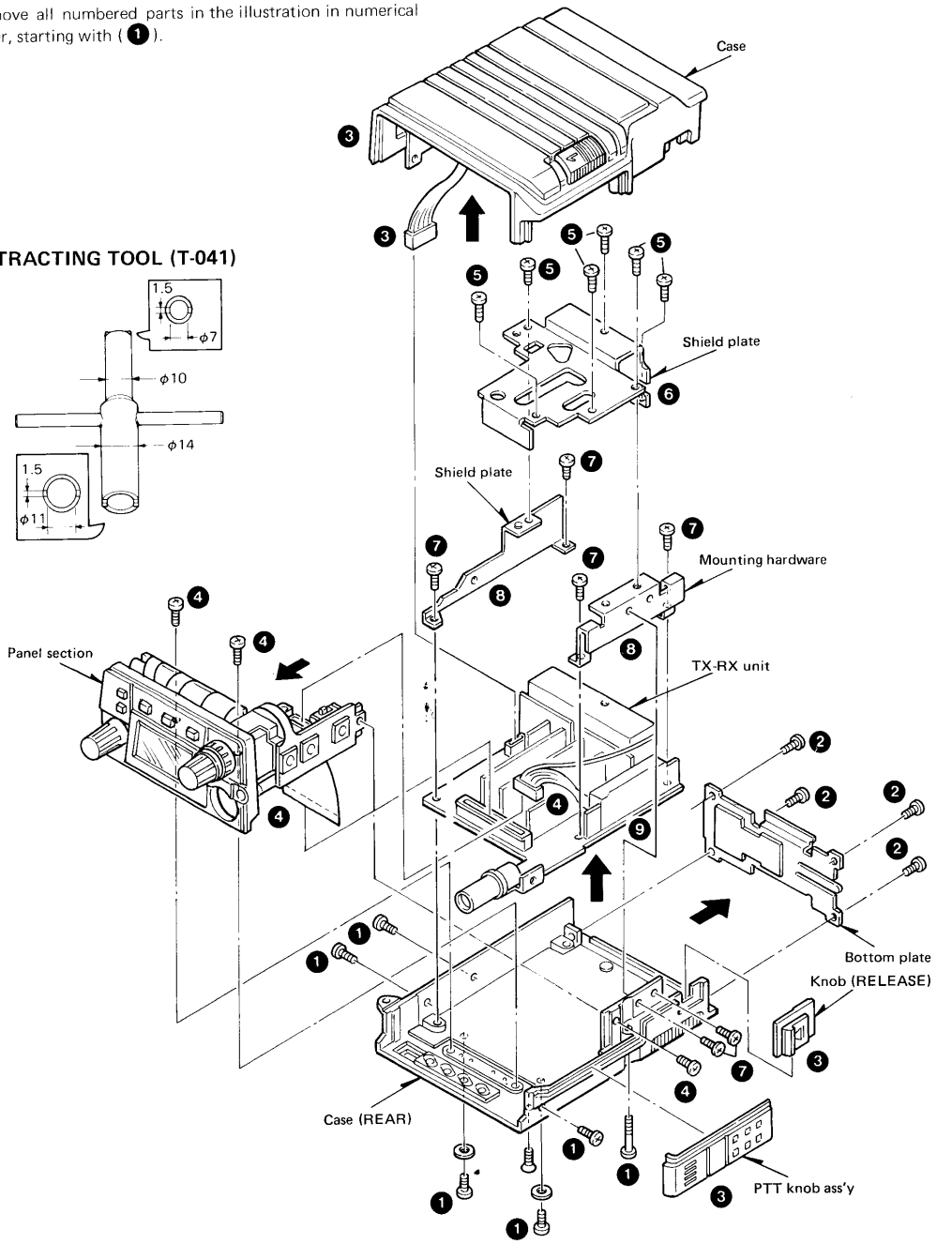
DISASSEMBLY FOR REPAIR

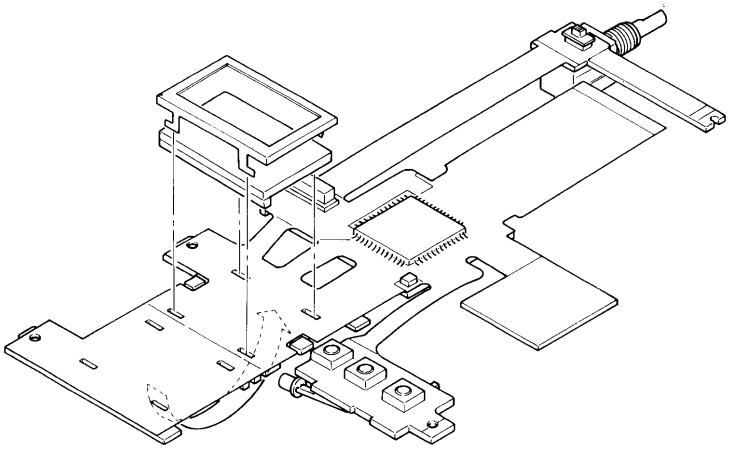
Remove all numbered parts in the illustration in numerical order, starting with (❶).

EXTRACTING TOOL (T-041)



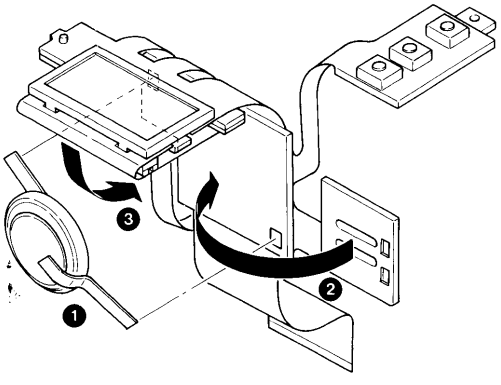
DISASSEMBLY FOR REPAIR

1. Attaching the LCD panel



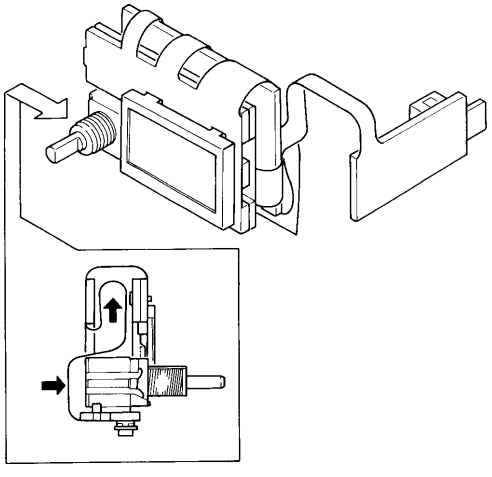
2. Assembling the FPC

1. Attach the lithium battery (❶).
2. Fold the section ❷ (❷).
3. Fold the LCD panel (❸).



3. Folding the flexible PC board

1. When attaching the encoder with the flexible cable connected to it, fold the flexible PC board about it as shown in the illustration.



CIRCUIT DESCRIPTION

FREQUENCY CONFIGURATION

The TH-25 utilizes a PLL synthesizer system and digital VFO. The VFO is capable of tuning in 5kHz and 10kHz steps, or 5kHz and 12.5kHz steps.

The receiver system configuration is based upon double super-heterodyne principles with a first intermediate frequency (IF) of 16.9MHz and a second intermediate frequency of 455kHz.

Incoming signals from the antenna are mixed with the first local oscillator signal to produce the first intermediate frequency of 16.9MHz. The first intermediate frequency is then mixed with the second local oscillator signal of 17.355 MHz to produce the second intermediate frequency of 455kHz.

Transmitter signals are generated by the PLL VCO then amplified and applied directly to the antenna circuit.

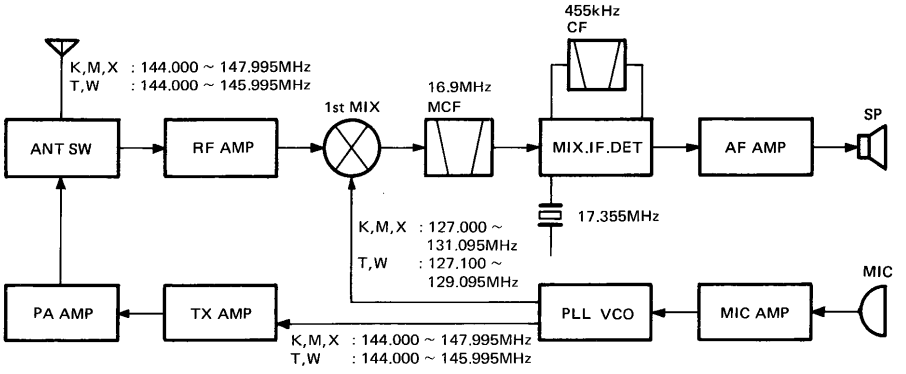


Fig. 1 Frequency configuration

RECEIVER SYSTEM

● General

Incoming signals from the antenna pass through a low-pass filter circuit and enter the front end circuits. The signals are amplified by a cascode amplifier Q1 : 2SC3937 and Q2 : 2SC4215(Y). Undesired signals are removed by a 3-pole tuning circuit utilizing variable capacitance diodes. The resulting signal is mixed with a signal from the PLL VCO by Q3 : 2SK302(Y) in the receiver front-end unit to produce the first intermediate frequency of 16.9MHz. The signal passes through the second monolithic crystal filter (MCF) to provide additional undesirable signal rejection. The signal passing through the MCF then enters IC1 : TK10487MT1 (B,C), in the IF unit, where it is combined with the second local oscillator signal to produce the second intermediate frequency of 455kHz. The 455kHz intermediate frequency signal passes through a ceramic filter (CF1), and then reenters IC1 for additional amplification and demodulation. The output of IC1 is amplified by an AF (Audio Frequency) amplifier IC1 : NJM386BM and applied to the speaker.

Item	Rating
Noninal center frequency (fo)	16.900kHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or less at 40dB fo ± 45kHz or less at 60dB
Guaranteed attenuation	70dB or more within fo ± 1MHz Spurious : 40dB or more at fo ~ fo + 500kHz, 80dB or more within ± 890 ~ 930kHz
Ripple	1.0dB or less
Insertion loss	2.0dB or less
Terminal impedance	1.8kΩ/0pF

Table 1 MCF (L71-0276-05) (TX-RX unit XF1, XF2)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455kHz ± 1.5kHz)
Gurauranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less
Terminal impedance	1.5kΩ

Table 2 Ceramic filter (L72-0362-05) (IF unit CF1)

CIRCUIT DESCRIPTION

● Squilch and Mute Circuit

This unit has the T.ALT (Tone Alert) function to produce two muting signals. When a signal is received while the T.ALT function is ON, only a beep will sound.

The microprocessor determines the current condition and provides muting signals MU1 and MU2 as necessary. The conditions required for mute operation are listed in the following table 3. When the microprocessor provides a logic high signal level, muting occurs.

Condition			MU1	MU2
Transmission			H	H
Reception	Normal operation	When Squelch is ON	H	H
		When Squelch is OFF	L	L
	T.ALT operation	Waiting for Signal	H	H
		Signal is Received (T.ALT operating)	L	H

Muted when the level is a logic "H".

Table 3 Muting conditions

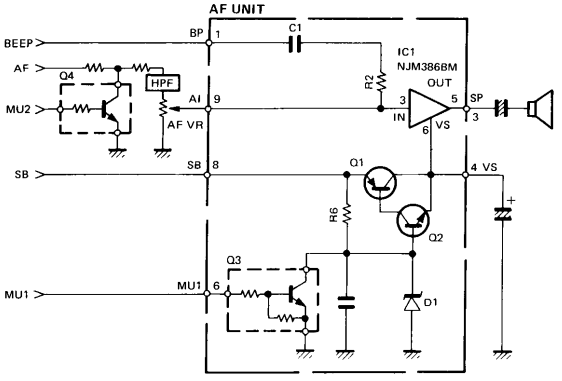


Fig. 2 Mute circuit

● S Meter Circuit

The signal used to drive the S-meter is provided from pin 12 by detecting the output from IF amplifier IC1 : TK 10487MT1(B,C). This signal is routed directly to pin 14 of the microprocessor and is used to control the S meter section of the LCD (Liquid Crystal Display). The indicators operate in pairs, thus providing six signal level indications.

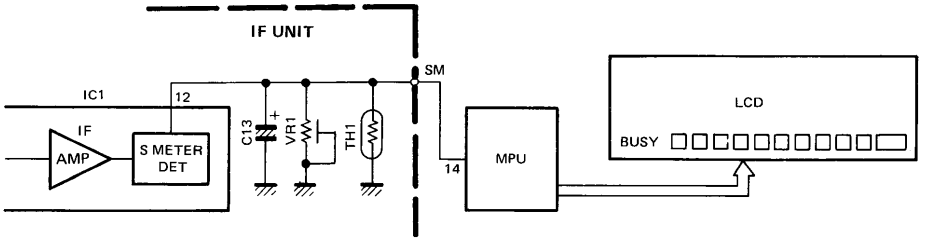


Fig. 3 S-meter circuit

CIRCUIT DESCRIPTION

TRANSMITTER SYSTEM

• General

Transmitter frequencies are obtained by generating the desired signals in the PLL (Phase Locked Loop) circuit.

Frequencies are directly modulated by using the microphone input to vary the voltage applied to the varactor diodes in the VCO (Voltage Controlled Oscillator) circuit.

The output from the VCO circuit is amplified and then applied to the driver and RF power module circuitry where the signal is amplified to the required level for transmission.

• Modulation Circuit

The signal from the microphone enters the MIC amplifier unit where it is amplified and then applied to a limiting amplifier. This signal is then applied to a splatter filter and the microphone gain control VR1. The signal from the microphone gain control is then applied to the MOD pin where it enters the PLL VCO unit. The signal is then applied to the VCO varicap diode D2 : MA344B in order to obtain the modulated transmit signal.

This method of modulation provides variable reactance phase modulation of the transmitter frequency.

The DTMF (Dual Tone Multi Frequency) signal (option) is fed to the DTMF pin of the MIC amplifier unit. The 1750 Hz tone is supplied from the MPU and applied to pin TI (Tone Input) of the microphone amplifier unit. This signal is filtered by a 1750Hz LPF (Low Pass Filter).

These signals are processed and routed in the same manner as the microphone signal itself.

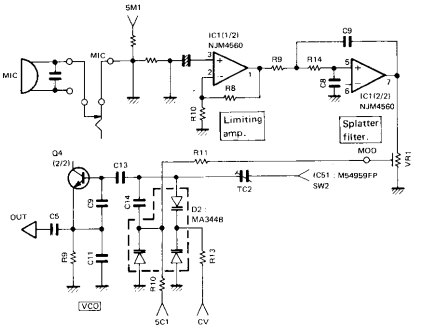


Fig. 4 Modulation circuit

• Drive and Final Cricuits

The modulated signal from the VCO enters the drive unit, passes through transmit/receive switch D1 and amplified to approximately +20dBm. The APC (Automatic Power Control) control voltage is used to vary the collector voltage of the driver transistor Q2 : 2SC2954, and thus assure a clean signal. The output from the driver is further amplified by the RF power module, IC1 : M57796MA, and then supplied to the ANT connections through the antenna switching circuit composed of D1 and D2.

• APC Circuit

The APC circuit has been provided to supply transmit power stabilization. This circuit is operated by detecting the collector current of the final module by sensing the voltage drop across R4 : 0.22Ω. The comparator IC1 : LM301AD compares this voltage with a 3.9V reference voltage from zener diode D1 : 02CZ3.9YZ and voltage dividers VR1, VR2, and R9. The comparator output is applied to Q1 : 2SA1162(Y) which applies the control voltage to the collector of Q2 in the driver module.

This operation keeps the input power of the final module constant and provides a stable output. Additionally it can be used to limit, somewhat, the current of the final module caused by load variations.

• Hi/Low Switching Circuit

The TH-25 has a transmit power selection switch that allows selection of 5W (with 12V power) in the high power setting and 0.5W in the low power setting. The data from this switch is used to control the output of the drive unit by changing the ratio of the voltage generated by D1, by turning APC unit Q1 : 2SA1162(Y) on and off, and also by changing the input voltage to the comparator.

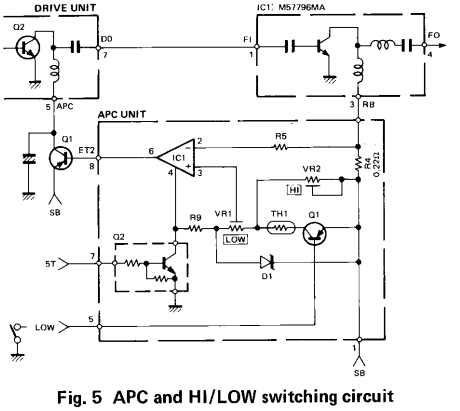


Fig. 5 APC and HI/LOW switching circuit

CIRCUIT DESCRIPTION

POWER SUPPLY CIRCUIT

The TH-25 generates a common supply voltage SB which is used to provide ; 5V (5T) for transmission, 5V (5R) for reception, 5V (5C) common transmit/receive voltage, and 5V (5M) for the microprocessor and MIC.

5T and 5R are switched by a signal from the TX terminal. During transmission, microprocessor pin 29 is at a "L" level, so that Q5 : 2SB1218 and Q2 : 2SA1313(Y) go ON and the 5C voltage is output at the 5T terminal. During reception, microprocessor pin 29 is at a "H" level (open), so that Q1 : 2SD1819 and Q3 : UN5119 go ON and the 5C voltage is output at the 5R terminal.

The normal 5C voltage is generated by a three terminal regulator IC1 : LP2950CZ, differential amplifier IC2 : IMX1 and Q3 : 2SB1182(Q), which is located off of the AVR unit.

The output from the 3 terminal regulator (IC1) is used as the bias voltage for the microprocessor and MIC.

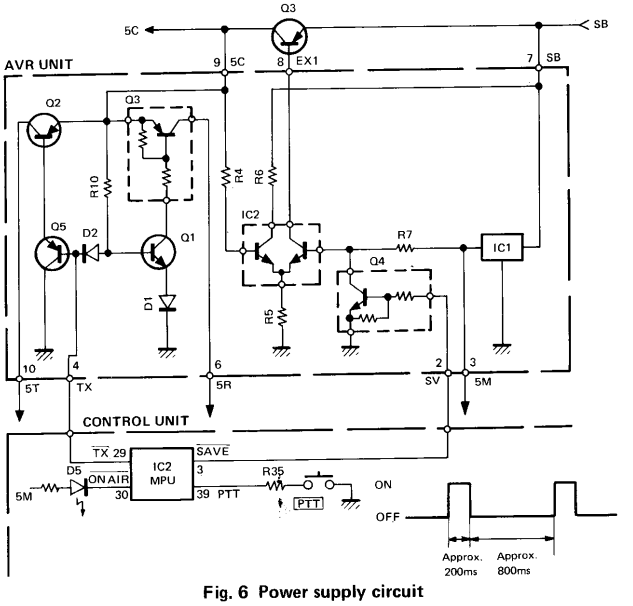


Fig. 6 Power supply circuit

• Battery Saver and Automatic Power OFF

The battery saver and automatic power off functions are provided to conserve on battery consumption when the system is waiting for an incoming signal. The battery saver and automatic power off operations are controlled by control signals from the SAVE pin 3 of the MPU : μPD 75108AG according to the appropriate conditions at that time.

When this signal is applied all DC power except the 5V : 5M used for the MPU and MIC are turned off. The save function alternates between normal DC voltage and the save condition based upon an 200m second on and 800m second off ratio, i.e. normal voltages for 200m second and 800m second MPU and MIC only voltages.

During the period the automatic power off function is active the 5C voltages are switched OFF to reduce the effective battery drain to approximately 6mA. This circuit will activate if no signal is received for 59 minutes. At this point the microprocessor will cause a 5 second audio tone to sound. One minute after this alert signal sounds the 5C voltages will turn off.

	Save operation	Power OFF operation
Operation starting time	Squelch closes for 10 seconds or more, and no key operation is possible.	Squelch closes for 60 minutes or more, and no key operation is possible. (A beep sounds for 5 seconds after 59 minutes.)
Reset Method	Receive a signal, open squelch, or perform key operation.	Press the MONI key, or turn the power switch ON again.
Display	Normal	poOFF

Table 4 Save and power off operation condition

CIRCUIT DESCRIPTION

PLL SYNTHESIZER

The TH-25 utilizes a VCO circuit design in which the transmit and receive sections are independent of each other. The two do make use of common LPF and PLL sections, however.

Comparison frequencies of 5kHz or 6.25kHz are used and correspond to the frequency steps of 5/10kHz or 5/12.5kHz respectively. The 12.8MHz reference oscillator frequency is divided into 1/2560 or 1/2048 to produce the 5kHz and 6.25kHz. The desired transmit and receive VCO frequencies are generated directly by the respective VCO. The transmit/receive signal is sent from pin 10 (SW1) of IC51 : M54959FP. The VCO output signals are sent to the drive unit, and applied to the PLL IC (IC51) simultaneously. This single-chip IC incorporate two modulas prescalers of 1/128 and 1/129, and is arranged in a pulse swallow type of configuration.

This IC also contains the phase comparator. The output of the comparator is applied through an active low-pass filter, Q52 : XN6501, and is applied to the varicap diode D2 : MA344B of the VCO circuit.

The PLL division ratio and frequency are expressed by the following equation :

General division ratio M = A + 128N

Where

A : Swallow counter division ratio

N : Main counter division ratio

The values of A and N are received from the microprocessor as serial data. The values of A and N used for transmit are different from those used for receive. Therefore, the general division ratio M for transmit will be different than that of the value of M calculated for receive. This data is stored in the 21 bit shift register.

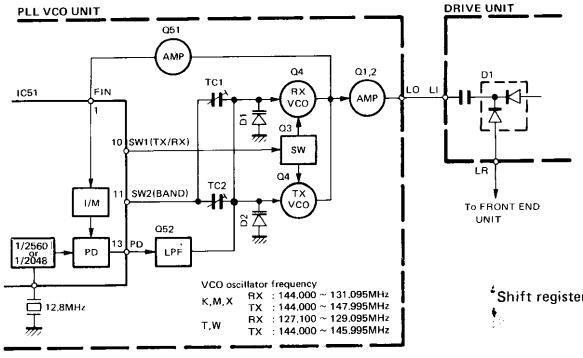


Fig. 7 PLL block diagram

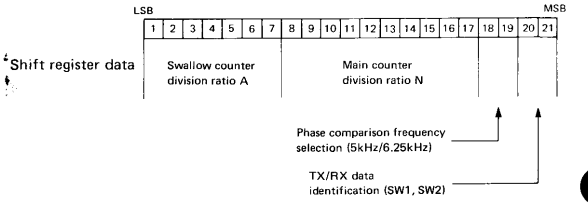

LSB
MSB
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Shift register data
Swallow counter division ratio A
Main counter division ratio N
Phase comparison frequency selection (5kHz/6.25kHz)
TX/RX data identification (SW1, SW2)

Fig. 8 PLL data configuration

MICROPROCESSOR & PERIPHERAL CIRCUITS

• Tone Alert Function (T.ALT)

The T.ALT function sounds a beep and flashes a bell display for 5 seconds to indicate that a incoming signal has been received. When the microprocessor detects that the T.ALT switch has been depressed (S2, I1) it causes a logic "H" to be applied to terminals MU1 and MU2.

The MU1 signal is used to turn the AF amplifier power (VS) off, and the MU2 signal is used to drop the input signal of the AF amplifier to ground by switching transistor Q4 : DTC143TU.

When a incoming signal from the antenna is receieved, the SC pin of the IF unit switches from a logic "H" to a logic "L". This informs the MPU BUSY pin that a signal has been received at the antenna terminal. When the microprocessor detects this signal it causes MU1 to go "L" which turns the AF amplifiers on.

While this is occurring a beep tone is generated by the microprocessor and is transmitted to the AF amplifier via the BEEP terminal of the microproessor and then applied to the speaker.

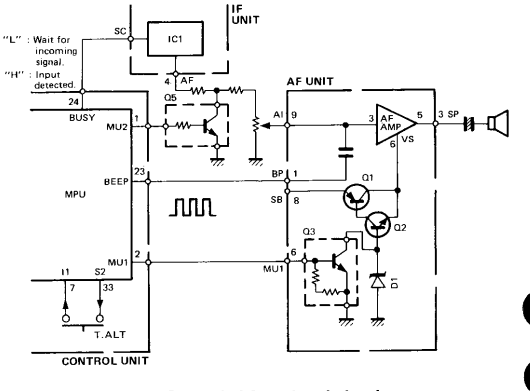


Fig. 9 T.ALT functional circuit

CIRCUIT DESCRIPTION

• Reset and Backup Circuits

Each of these operations is controlled by detecting the state of the 5M line. The microprocessor is reset by applying a pulse, generated by C1 and Q1 : 2SC2712(Y) when the power switch is pressed, to the MPU RESET pin. Backup operations are controlled when the 5M voltage drops to approximately 4.5V (4.3 thru 4.6V). When this occurs the output of IC3 : S8054ALR goes "L". This is felt on the VF pin of the microprocessor and causes the microprocessor to enter the backup mode.

When the 5M voltage increases suddenly, such as when turning on the power switch, the microprocessor will reset. When the voltage rises gradually, the leading edge of the signal supplied from IC3 will change from "L" to "H", which will also reset the microprocessor.

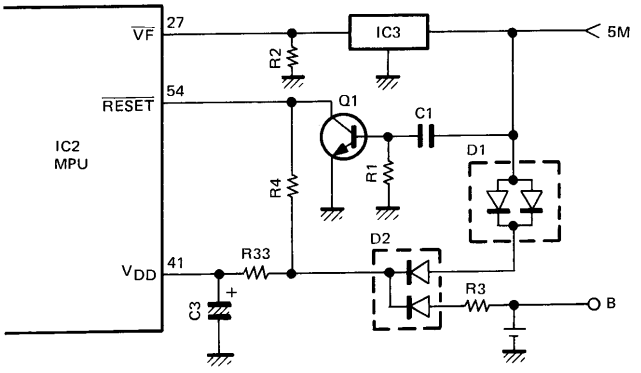


Fig. 10 Reset and backup circuit

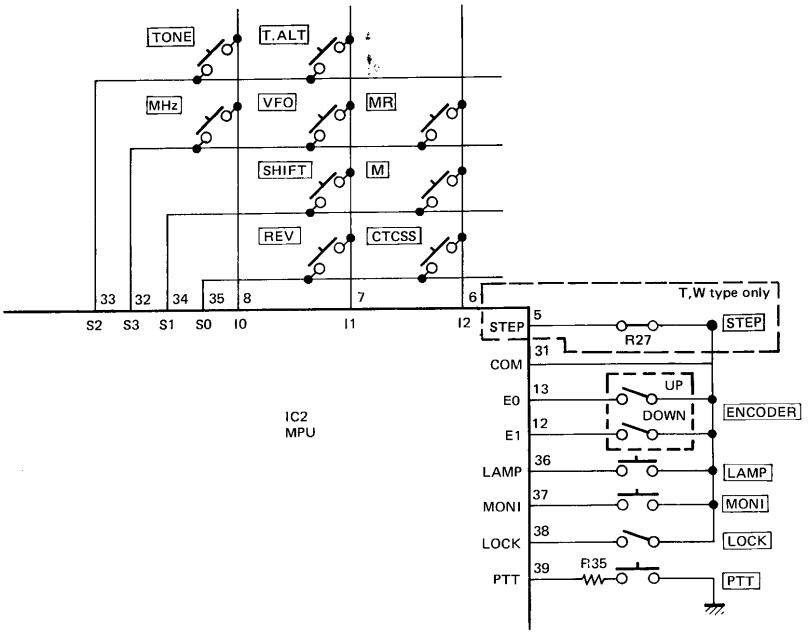
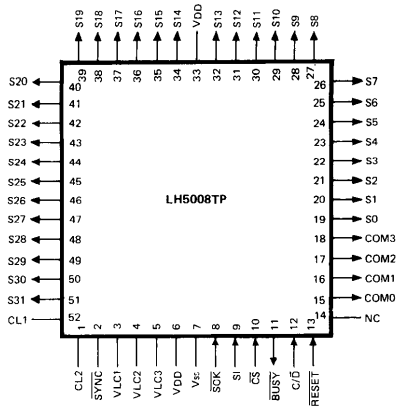


Fig. 11 Keyboard

SEMICONDUCTOR DATA

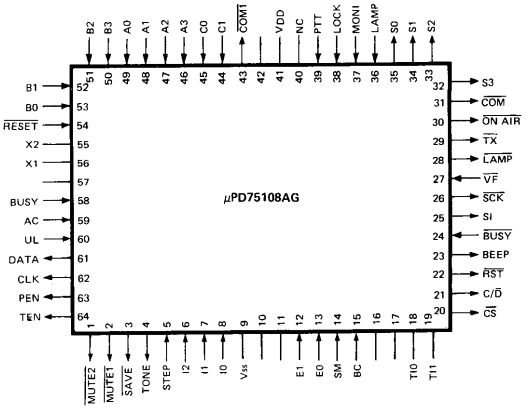
LH5008TP (Control unit IC1)

● **Terminal connection diagram**


LH5008TP
S19 S18 S17 S16 S15 S14 VDD S13 S12 S11 S10 S9 S8
S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 CL1
S7 S6 S5 S4 S3 S2 S1 S0 COM3 COM2 COM1 COM0 NC
CL2 SYNC VLC1 VLC2 VLC3 VDD VSS SCK SI CS BUSY C/D RESET

μPD75108AG (Control unit IC2)

● **Terminal connection diagram**


μPD75108AG
B2 B3 A0 A1 A2 A3 C0 C1 COM1 VDD NC PTT LOCK MONI LAMP S0 S1 S2
B1 B0 RESET X2 X1 BUSY AC UL DATA CLK PEN TEN
S3 COM ON AIR TX LAMP VF SCK SI BUSY BEEP RST C/D CS
MUTE2 MUTE1 SAVE TONE STEP I2 I1 I0 VSS E1 E0 SM BC T10 T11

● **Terminal functions (LH5008TP)**

Pin No.	Name	I/O	Function
1	CL2	–	Internal clock oscillation resistance pin.
2	$\overline{SYNC}$	–	Not used.
3, 4	VLC1, VLC2	–	LCD driver power supply.
5	VLC3	–	Ground.
6	VDD	–	+5V power supply.
7	VSS	–	Ground.
8	$\overline{SCK}$	I	Shift clock input.
9	SI	I	Serial data input.
10	$\overline{CS}$	I	Enable input. "L" : Data input enabled, "H" : Contents of the memory are output
11	$\overline{BUSY}$	O	Data input control. "L" : Inhibit, "H" : Permit
12	C/$\overline{D}$	I	Input data indetification input. "L" Data, "H" : Command
13	$\overline{RESET}$	I	Reset input.
14	NC	–	
15 ~ 17	COM0 ~ COM2	O	Common drive output.
18	COM3	O	Not used.
19 ~ 32	S0 ~ S13	O	Segment drive output.
33	VDD	–	+5V power supply.
34 ~ 45	S14 ~ S25	O	Segment drive output.
46 ~ 51	S26 ~ S31	O	Not used.
52	CL1	–	Internal clock oscillation resistance pin.

SEMICONDUCTOR DATA

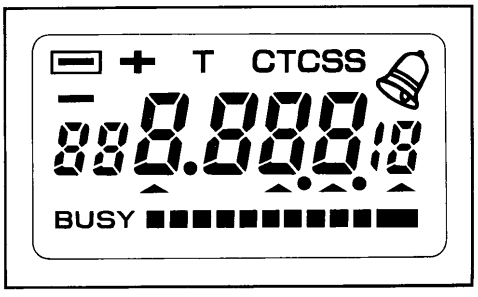
● **Terminal functions (μPD75108AG)**

Pin No.	Name	I/O	During save	Function
1	$\overline{MUT2}$	O	L	AF input line control. "L" : ON, "H" : OFF
2	$\overline{MUT1}$	O	H	AF amplifier power control. "L" : ON, "H" : OFF
3	$\overline{SAVE}$	O	H	Power save control. "L" : ON, "H" : OFF
4	TONE	O	L	Tone output. During transmit, 1750Hz. **T, W Type**
5	STEP	I	–	Step control. "L" : ON, "H" : OFF
6	I2	I	–	Key matrix input. M, CTCSS, MR
7	I1	I	–	Key matrix input. VFO, T.ALT, SHIFT, REV
8	I0	I	–	Key matrix input. MHz, TONE
9	Vss	–	–	Ground.
10, 11	–	–	–	Ground.
12	E1	I	–	Encoder input. DOWN
13	E0	I	–	Encoder input. UP
14	SM	I	–	S meter input.
15	BC	I	–	Battery voltage check.
16, 17	–	–	–	Ground.
18	TI0	–	–	Ground.
19	TI1	–	–	Ground.
20	$\overline{CS}$	O	H	LCD driver control output.
21	C/$\overline{D}$	O	H	LCD driver control output.
22	$\overline{RST}$	O	H	LCD driver control output.
23	BEEP	O	L	Square wave output when BEEP is on.
24	$\overline{BUSY}$	I	–	LCD driver control output.
25	SI	O	–	LCD driver control output.
26	$\overline{SCK}$	O	–	LCD driver control output.
27	$\overline{VF}$	I	–	Perform backup operation when the 5M voltage drops.
28	$\overline{LAMP}$	O	H	Lamp ON/OFF control. "L" : ON, "H" : OFF
29	$\overline{TX}$	O	H	Transmit/receive switching. "L" : Transmit, "H" : Receive
30	$\overline{ON\ AIR}$	O	H	ON AIR display output. "L" : ON, "H" : OFF
31	$\overline{COM}$	O	L	"L" : normal, "H": during save or backup.
32	S3	O	L	Key matrix output. MHz, VFO, MR
33	S2	O	L	Key matrix output. TONE, T.ALT
34	S1	O	L	Key matrix output. M, SHIFT
35	S0	O	L	Key matrix ourpur. CTCSS, REV
36	LAMP	I	–	Lamp switch control. "L" : SW ON, "H" : SW OFF
37	MONI	I	–	Monitor switch control. "L" : SW ON, "H" : SW OFF
38	LOCK	I	–	Lock switch control. "L" : SW ON, "H" : SW OFF
39	PTT	I	–	PTT switch control. "L" : SW ON, "H" : SW OFF
40	NC	–	–	Open.
41	VDD	–	–	+5V power supply.
42	–	–	–	Ground.
43	$\overline{COM1}$	O	L	
44	C1	I	H	Display switching. "L" : Normal display, "H" : Channel display
45	C0	I	–	VHF/UHF switching. "L" : VHF, "H" : UHF
46 ~ 49	A3 ~ A0	I	–	Destination.
50 ~ 53	B3 ~ B0	I	–	Destination.
54	$\overline{RESET}$	I	–	System reset.
55	X2	–	–	
56	X1	–	–	
57	–	–	–	Open.
58	BUSY	I	–	Busy control. "L" : Open, "H" : Busy
59	AC	I	–	Tone squelch control output. "L" : No match, "H" : Match
60	UL	I	–	Unlock output. "L" : Lock, "H" : Unlock
61	DATA	O	L	PLL, TONE data.
62	CLK	O	L	PLL, TONE clock.
63	PEN	O	L	PLL enable.
64	TEN	O	L	CTCSS enable.

SEMICONDUCTOR DATA

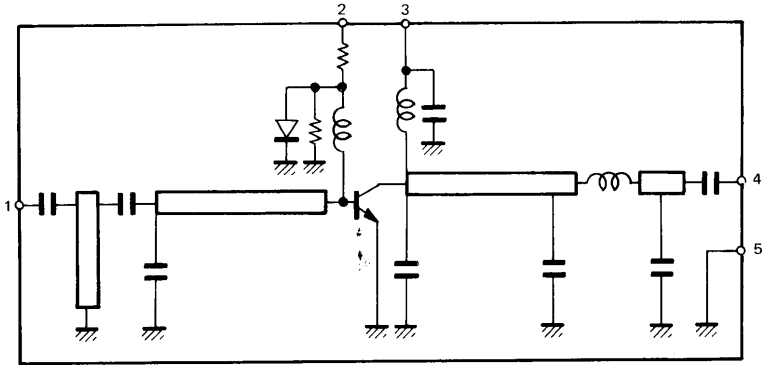
FTD8608 (Control unit LCD)

- **All lighting**



M57796MA (TX-RX unit IC1)

- **Equivalent circuit**



1 : Input
2 : Bias + B
3 : + B
4 : Output
5 : GND (Fin)

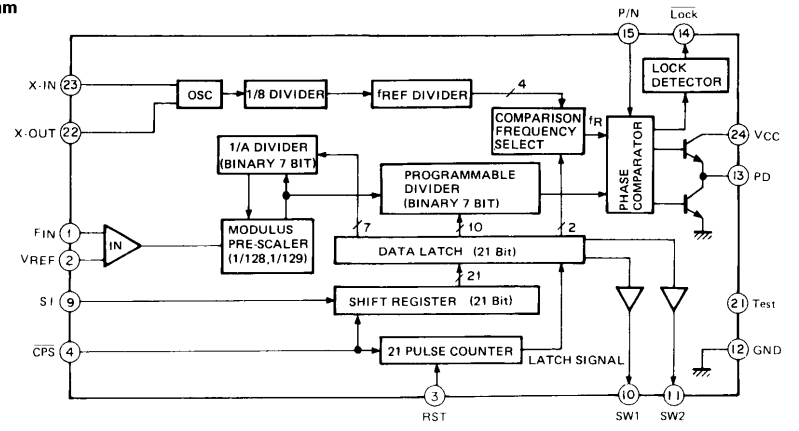
- **Electrical characteristics**

Item	Sumbol	Rating			Unit	Condition
		MIN.	TYP.	MAX.		
Output power	Po	7	8		W	Tc = 25°C
Total efficiency	ηT	50	55		%	Vcc = 12.5V
2nd spurious				–20	dB	V_{BB} = 5V
Spurious after 3rd				–30	dB	f = 144 ~ 148MHz
Output SWR	ρ out		1.5		–	Pin = 200mW
Input SWR	ρ in			2.5	–	$Z_G = Z_L = 50\Omega$
Operating voltage	Vcc			16	V	

SEMICONDUCTOR DATA

M54959FP (PLL unit IC51)

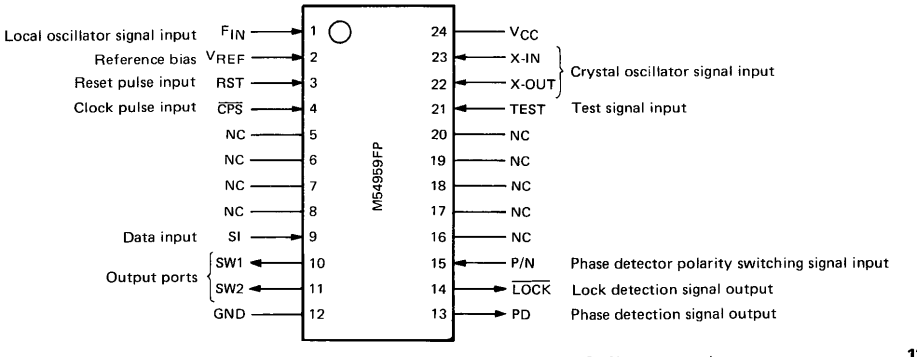
• Block diagram



• Description of terminals

No.	Symbol	Pin name	Description
1	F_{IN}	Local oscillator signal input	Local oscillator frequency (VCO) input. f_{MAX} = 500MHz.
2	V_{REF}	Reference bias	Grounded by a 1000pF capacitor.
3	RST	Reset pulse input	Reset pulse input for 21-pulse counter.
4	$\overline{CPS}$	Clock pulse input	Clock pulse input for shift register.
5 ~ 8	NC	Not connected	Use for open or ground.
9	SI	Data input	Data input for shift register.
10	SW1	Output ports	Output ports whose status is determined by the data sent from the controller. Open collector.
11	SW2		
12	GND	Ground	0V.
13	PD	Phase detection signal output	Tristate.
14	$\overline{LOCK}$	Lock detection signal output	"L" when the PLL unit is locked, "H" when it is unlocked. Open collector.
15	P/N	Phase detector polarity switching	When this pin is "H", the PD pin is "H" for phase lead and "L" for phase delay. When this pin is "L", the PD pin is "L" for phase lead and "H" for phase delay.
16 ~ 20	NC	Not connected	Use for open or ground.
21	TEST	Test signal input	Usually "L". When this pin is "H", f_R (comparison frequency) and f_{IN}/N (programmable divider) are output from SW1 (pin 10) and SW2 (pin 11), respectively.
22	X-OUT	Liquid crystal oscillator signal input	Inputs signals sent from the 12.8MHz basic oscillator to X-IN. Oscillation is possible even when an external crystal resonator is used.
23	X-IN		
24	V_{CC}	Power supply	4.5 ~ 5.5V.

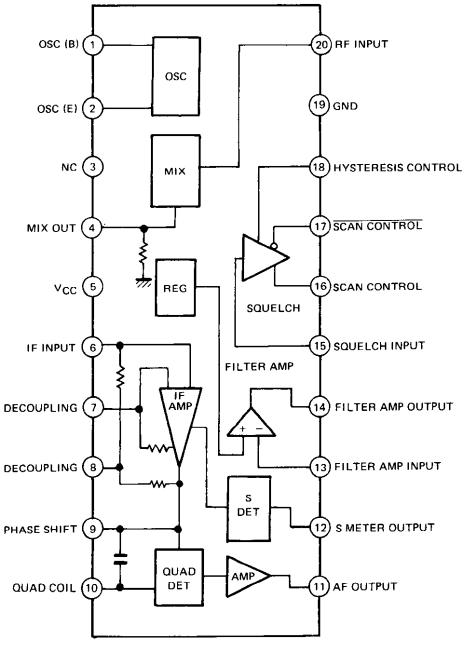
• Terminal connection diagram



SEMICONDUCTOR DATA/DESCRIPTION OF COMPONENTS

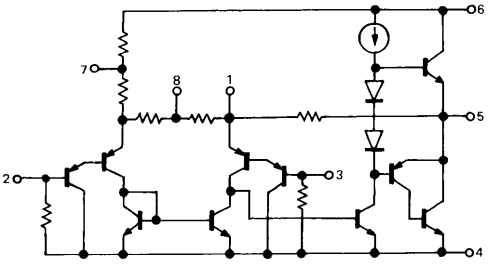
TK10487MT1 (IF unit IC1)

● **Block diagram**



NJM386BM (AF AMP. unit IC1)

● **Equivalent circuit**



● **Electrical characteristics**

Item	Symbol	Rating			Unit	Condition
		MIN.	TYP.	MAX.		
Supply voltage	Vs	4	–	18	V	
Output power	Pour	500	850	–	mW	Vs = 9V, R_L = 8Ω, THD = 10%
Voltage gain	Av		46		dB	f = 1kHz, Between 1 and 8 : Connect capacitor (10μF).
Bandwidth	BW		600		kHz	Between 1 and 8 : Open.
Distortion	THD		0.2		%	f = 1kHz, Pour = 125mW,
Input resistance	RIN		50		kΩ	R_L = 8Ω

Description of Components

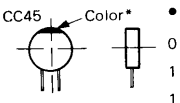
TX-RX UNIT (X57-3160-XX)

Component	Part No.	Operation/Condition/Compatibility
Q1	2SB1182(Q)	APC control output.
Q2	2SC2714(O)	Amplification of the second intermediate frequency of 16.9MHz.
Q3	2SB1182(Q)	5C (5V) AVR.
Q4	DTC143TU	AF mute (MU2).
Q5	DTC114EU	Switch which stops the VCO output to pin LR during transmit.
Q9	DTC143TK	Mic mute.
Q101	2SC4116(GR)	300Hz HPF.
IC1	M57796MA	Power amplification.
D1	MI303	Transmit/receive switching. ON during transmit.
D2	HSK277	Transmit/receive switching. ON during transmit.
D4	DAN202U	Isolation of BY (AF amp.) from 5M.

PARTS LIST

CAPACITORS CC 45 TH 1H 220 J
1 2 3 4 5 6

1 = Type ..... ceramic, electrolytic, etc.
2 = Shape .....round, square, etc.
3 = Temp. coefficient
4 = Voltage ratlng
5 = Value
6 = Tolerance



- **Capacitor value**

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF
1 0 3 = 0.01μF

2 2 0 = 22pF
1st number | Multiplier
2nd number

- **Temperature Coefficient**

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	−80	−150	−220	−330	−470	−750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = −470 ± 60 ppm/°C

- **Tolerance**

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40 −20	+ 80 −20	+ 100 −0	More than 10μF−10~ + 50 Less than 4.7μF−10~ + 75

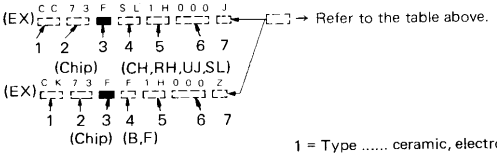
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

- **Rating voltage**

2nd word / 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	–
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	–
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	–

- **Chip capacitors**

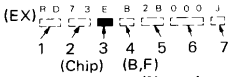


Dimension

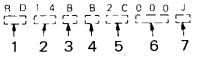
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

RESISTORS

- **Chip resistor (Carbon)**



- **Carbon resistor (Normal type)**



1 = Type ..... ceramic, electrolytic, etc.
2 = Shape ..... round, square, etc.
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance.

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1 /10W	2E	1/ 4W	3A	1W
2B	1/ 8W	2H	1/ 2W	3D	2W
2C	1/ 6W				

Dimension

Scan by Dan

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			TH-25A/AT/E			
1	3B	*	A01-1038-02	METALLIC CABINET(REAR)		
4	1A	*	A02-0836-03	PLASTIC CABINET (FRONT)		B
4	1A	*	A02-0838-02	PLASTIC CABINET (FRONT)		A
4	1A	*	A02-0839-02	PLASTIC CABINET (FRONT)		C
5	2B	*	A11-0405-04	SUB CHASSIS ASSY(VOL)		
6	2B	*	A11-0406-04	SUB CHASSIS ASSY(ENCODER)		
7	2A	*	A20-2625-03	PANEL ASSY		
10	3B	*	A40-0621-04	BOTTOM PLATE		
-			A02-0814-13	PLASTIC CABINET		B
-		*	A20-2630-04	PANEL		
-			A40-0622-04	BOTTOM PLATE		B
14	3B	*	B01-0661-03	PANEL ESCUTCHEON		
15	2D	*	B09-0309-04	CAP (SP,MIC)		
16	2A	*	B10-0698-04	FRONT GLASS		
17	2A	*	B11-0449-04	REFLECTOR		
18	3B	*	B40-3747-04	MODEL NAME PLATE(BATT CASE)		B
18	3B	*	B40-3763-04	MODEL NAME PLATE(BATT CASE)		A
18	3B	*	B40-3764-04	MODEL NAME PLATE(BATT CASE)		C
20	3B		B42-2437-04	LABEL (SERIAL)		
22	2D	*	B42-3325-04	LABEL		
23	1D		B46-0410-20	WARRANTY CARD	K	B
24	1D	*	B50-8170-20	INSTRUCTION MANUAL		
-		*	B03-0547-04	DRESSING PLATE (DTMF)		B
-			B42-2454-04	LABEL (SERIAL)		
-			B42-3301-04	LABEL	K	B
C1			CC73FCH1H390J	CHIP C 39PF J		
30	3B	*	E04-0168-05	BNC RECEPTACLE		
31	3B	*	E23-0494-14	TERMINAL (POWER,-)		
37	3B	*	E23-0607-04	TERMINAL (BNC)		
-		*	E23-0605-14	TERMINAL (POWER,+)		
-		*	E31-3279-25	CONNECTING WIRE(CTCSS)		
-		*	E31-3332-05	CONNECTING WIRE(TX,RX-JACK)		
46	2B	*	F10-1364-14	SHIELDING PLATE		
47	1B	*	F10-1365-14	SHIELDING PLATE		
48	2B	*	F11-1097-04	SHIELDING COVER(POWER MODULE)		
49	1A	*	F19-0658-04	BLIND PLATE (MIC)		
51	3B	*	F20-0593-14	INSULATING BOARD(TX.RX)		
52	2A	*	F20-0594-04	INSULATING BOARD(CONTROL)		
53	1A	*	F20-0596-04	INSULATING BOARD(JACK)		
54	3B	*	F29-0435-05	INSULATOR (BELT HOOK)		
55	3B		F20-1008-04	INSULATING BOARD(BOTTOM CASE)		
56	2B	*	F20-1009-04	INSULATING BOARD(SHIELDING PLT		
-			F20-0587-04	INSULATING BOARD(LITHIUM BATT)		
58	2A		G02-0505-05	SPRING (VOL,ENCODER)		
59	1A		G10-0657-04	NON-WOVEN FABRIC		A
59	1A		G10-0657-04	NON-WOVEN FABRIC		C
59	1A	*	G10-0664-04	NON-WOVEN FABRIC		B
60	3B		G13-0852-04	CUSHION (POWER)		
62	3B	*	G16-0514-04	SHEET		
63	1A		G53-0508-04	NON-WOVEN FABRIC		

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67	3C	*	H01-8111-02	ITEM CARTON BOX		B
67	3C	*	H01-8155-02	ITEM CARTON BOX		C
67	3C	*	H01-8156-02	ITEM CARTON BOX		A
69	3D	*	H10-2635-02	POLYSTYRENE FOAMED FIXTURE		B
70	1D		H11-0808-14	POLYSTYRENE PLATE		
71	2D		H13-0801-04	PROTECTION SHEET		
72	2D	*	H13-0818-04	PROTECTION SHEET		
73	1D	*	H21-0715-04	PROTECTION SHEET		
75	2D		H25-0085-04	PROTECTION BAG (100X200)		
79	3B	*	J19-1426-03	HOLDER		
80	2B	*	J21-4219-04	MOUNTING HARDWARE(POWER MODULE		
82	1A	*	J21-4221-04	MOUNTING HARDWARE(SPEAKER)		
83	1A	*	J21-4222-04	MOUNTING HARDWARE(SP,MIC JACK)		
85	2D	*	J29-0424-04	BELT HOOK		
86	1A	*	J30-0547-04	SPACER (SPEAKER)		
87	1A		J31-0526-04	SPACER (MIC)		
88	2A	*	J69-0311-05	RING (BNC)		
89	2D	*	J69-0312-04	HAND STRAP		
90	1A	*	J21-4223-04	MOUNTING HARDWARE(CASE)		
91	1A	*	J30-0548-04	SPACER (SPEAKER)		B
--		*	J99-0311-04	SHEET		
94	3A	*	K27-0499-04	KNOB (HI/LO)		
95	1B	*	K27-0500-04	KNOB (F.LOCK)		A
95	1B	*	K27-0500-04	KNOB (F.LOCK)		C
95	1B	*	K27-3001-04	KNOB (F.LOCK)		B
96	2A	*	K29-3096-04	KNOB ASSY (VOL)		
97	2A	*	K29-3097-04	KNOB ASSY (SQL)		
98	2A	*	K29-3098-04	KNOB ASSY (ENCODER)		
99	3B	*	K29-3100-04	KNOB ASSY (RELEASE)		
100	3B	*	K29-3102-03	KNOB ASSY (PTT)		
101	2A	*	K29-3103-04	KEY TOP (MHZ,M.CH)		
102	3A	*	K29-3104-04	KEY TOP (REV,M)		
103	1A	*	K29-3105-04	KEY TOP (DTMF)		B
104	2A	*	N14-0534-04	NUT (VOL,ENCODER)		
A	3B		N09-0663-04	SCREW		
B	3B	*	N09-2022-05	SCREW (M2X4)		
C	1A,3B	*	N09-2023-05	SCREW (M2X3)		
D	3B	*	N09-2024-05	SCREW (Ø2X16)		
E	3B	*	N09-2025-05	SCREW (Ø1.7X3)		
F	1A	*	N09-2026-05	SCREW (Ø2X3.5)		
G	3B	*	N09-2028-05	SCREW (M3X4)		
J	2B		N30-2005-41	PAN HEAD MACHINE SCREW		
K	3B		N33-2005-45	OVAL HEAD MACHINE SCREW		
L	1B,2B		N35-2003-41	BINDING HEAD MACHINE SCREW		
R1			RD14BB2B333J	RD 33K J 1/8W		
111	1A	*	T07-0251-05	LOUDSPEAKER		
112	1D	*	T90-0356-05	ANTENNA		
113	1A	*	T91-0372-05	MICROPHONE		
122	3D		W09-0382-15	BATTERY CHARGER(120V)	K	B
122	3D		W09-0382-15	BATTERY CHARGER(120V)	M4	A
122	3D		W09-0384-05	BATTERY CHARGER(220V)	M	B
122	3D		W09-0384-05	BATTERY CHARGER(220V)	MM3	A

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122	3D		W09-0385-05	BATTERY CHARGER(120V)	M2	B
122	3D		W09-0385-05	BATTERY CHARGER(120V)	M2	A
122	3D		W09-0386-05	BATTERY CHARGER	X	A
122	3D		W09-0387-05	BATTERY CHARGER	T	C
122	3D		W09-0388-05	BATTERY CHARGER	W	C
123	2C		W09-0507-05	BATTERY PACK (PB-6)		
-		*	W09-0394-05	LITHIUM BATTERY		
126	2A	*	X53-3080-11	CONTROL UNIT	K	B
126	2A	*	X53-3080-12	CONTROL UNIT	MM2	B
126	2A	*	X53-3080-12	CONTROL UNIT	MM2	A
126	2A	*	X53-3080-23	CONTROL UNIT	M3M4X	A
126	2A	*	X53-3080-52	CONTROL UNIT	T	C
126	2A	*	X53-3080-62	CONTROL UNIT	W	C
127	1A,2B	*	X57-3160-10	TX.RX UNIT		B
127	1A,2B	*	X57-3160-21	TX.RX UNIT		A
127	1A,2B	*	X57-3160-61	RX.RX UNIT		C
128	1A	*	X52-3090-10	SIGALING UNIT		B
SIGNALING UNIT (X52-3090-10)						
C1			CE04CW0J100M	ELECTRO 10UF 6.3WV		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73EB1E104K	CHIP C 0.10UF K		
C4			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C5			CK73FB1H332K	CHIP C 3300PF K		
C6			C92-0009-05	CHIP TAN 4.7UF 10WV		
C7 ,8			CK73FB1H102K	CHIP C 1000PF K		
C9			C92-0008-05	TANTAL 3.3UF 16WV		
L1		*	L78-0035-05	RESONATOR		
R2			RK73FB2A154J	CHIP R 150K J 1/10W		
R3			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R4			RK73FB2A563J	CHIP R 56K J 1/10W		
R5			RK73FB2A101J	CHIP R 100 J 1/10W		
R6			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8 ,9			R92-0670-05	CHIP R 0 OHM		
VR1			R12-3460-05	TRIMMING POT. (33K)		
IC1			LR40872	IC(TONE DIALER)		
Q1			2SC2712(GR)	CHIP TRANSISTOR		
CONTROL UNIT (X53-3080-XX)						
9	2A	*	A33-0409-04	REFLECTOR (LCD)		
C1			CK73FB1H223K	CHIP C 0.022UF K		
C2			CK73FB1H103K	CHIP C 0.010UF K		
C3			C92-0010-05	TANTAL 6.8UF 6.3WV		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5 -7			CK73FB1H103K	CHIP C 0.010UF K		
C10		*	CK73GB1H102K	CHIP C 1000PF K		
40	2A	*	E29-0478-04	LCD CONNECTOR		
81	2A	*	J21-4220-04	MOUNTING HARDWARE(LCD)		
X1		*	L78-0036-05	RESONATOR (4.19MHZ)		
R1			RK73FB2A563J	CHIP R 56K J 1/10W		
R2			RK73FB2A183J	CHIP R 18K J 1/10W		

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R3			RK73FB2A333J	CHIP R 33K J 1/10W		
R4			RK73FB2A473J	CHIP R 47K J 1/10W		
R5			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R6 ,7			RK73FB2A473J	CHIP R 47K J 1/10W		
R8			RK73FB2A331J	CHIP R 330 J 1/10W		
R9			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R11 -15			RK73FB2A473J	CHIP R 47K J 1/10W		
R16			RK73FB2A184J	CHIP R 180K J 1/10W		
R17			RK73FB2A390J	CHIP R 39 J 1/10W		
R18 -22			R92-0670-05	CHIP R 0 OHM	K	
R18 -22			R92-0670-05	CHIP R 0 OHM	MM2	
R18 -22			R92-0670-05	CHIP R 0 OHM	M3M4X	
R22			R92-0670-05	CHIP R 0 OHM	T	
R22			R92-0670-05	CHIP R 0 OHM	W	
R25			R92-0670-05	CHIP R 0 OHM	K	
R25 -28			R92-0670-05	CHIP R 0 OHM	W	
R26 -28			R92-0670-05	CHIP R 0 OHM	T	
R28			R92-0670-05	CHIP R 0 OHM	M3M4X	
R31 -35			R92-0670-05	CHIP R 0 OHM		
R36			R92-0670-05	CHIP R 0 OHM	T	
R36			R92-0670-05	CHIP R 0 OHM	W	
S1 -3		*	S40-1415-05	TACT SWITCH		
S4		*	S31-1420-05	SLIDE SWITCH (F.LOCK)		
S5		*	S31-2414-05	SLIDE SWITCH (HI/LO)		
117	2A	*	FTD8608	LCD		
D1 ,2			1SS184	CHIP DIODE		
D3 ,4			1SS181	CHIP DIODE		
D5	2A		SLH34VC3	LED (TX)		
D6 ,7			LN0131C(Q)	LED (LCD)		
IC1		*	LH5008TP	IC(LCD CONTROLLER/ DRIVER)		
IC2			75108AG-018-22	IC(MICROPROCESSOR)	TW	
IC2			75108AG-021-22	IC(MICROPROCESSOR)	KMM2	
IC2			75108AG-021-22	IC(MICROPROCESSOR)	M3M4X	
IC3			S8054ALR-LN	IC		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2			2SA1162(Y)	CHIP TRANSISTOR		
121	2A	*	W02-0400-05	ENCODER		
TX-RX UNIT (X57-3160-XX) -10:TH-25AT -21:TH-25A -61:TH-25E						
C1			CC73FCH1H101J	CHIP C 100PF J		
C2			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C4			C90-2053-05	ELECTRO 47UF 6.3WV		
C5			CK73FB1H102K	CHIP C 1000PF K		
C6			C90-2053-05	ELECTRO 47UF 6.3WV		
C8			CK73FB1H102K	CHIP C 1000PF K		
C9			C90-2073-05	ELECTRO 6.8UF 16WV		
C10			CK73EF1C105Z	CHIP C 1.0UF Z		
C11			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			C90-2073-05	ELECTRO 6.8UF 16WV		
C14 ,15			CK73FB1H102K	CHIP C 1000PF K		
C16			CC73FCH1H120J	CHIP C 12PF J		
C17			CC73FCH1H150J	CHIP C 15PF J		

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C18			CK73FB1H102K	CHIP C 1000PF K		
C19			CC73FCH1H220J	CHIP C 22PF J		
C20			CC73FCH1H090D	CHIP C 9.0PF D		
C21			CC73FCH1H390J	CHIP C 39PF J		
C22			CC73FCH1H040C	CHIP C 4.0PF C		
C23			CC73FCH1H180J	CHIP C 18PF J		
C24			CC73FCH1H220J	CHIP C 22PF J		
C25			CC73FCH1H200J	CHIP C 20PF J		
C26			CC73FCH1H470J	CHIP C 47PF J		
C27			CK73FB1H102K	CHIP C 1000PF K		
C28			CC73FCH1H080D	CHIP C 8.0PF D		
C29 -31			CK73FB1H102K	CHIP C 1000PF K		
C32			CE04CW0J100M	ELECTRO 10UF 6.3WV		
C33			C90-2073-05	ELECTRO 6.8UF 16WV		
C34			C90-2050-05	ELECTRO 33UF 6.3WV		
C35			C90-2053-05	ELECTRO 47UF 6.3WV		
C36			C90-2058-05	ELECTRO 47UF 10WV		
C37			C90-2052-05	ELECTRO 68UF 10WV		
C38			C90-2049-05	ELECTRO 15UF 6.3WV		
C39 ,40			CK73FB1H102K	CHIP C 1000PF K		
C41			C92-0507-05	TANTAL 4.7UF 6.3WV		
C42 ,43			CK73FB1H102K	CHIP C 1000PF K		
C44			CK73FF1E154Z	CHIP C 0.15UF Z		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46		*	CK73FB1E473M	CHIP C 0.047UF M		
C47 ,48			CK73FB1H102K	CHIP C 1000PF K		
C51			CK73FB1H102K	CHIP C 1000PF K		
C52 -54			CC73FCH1H101J	CHIP C 100PF J		
C55			CC73FCH1H330J	CHIP C 33PF J		
C59			CK73FB1H102K	CHIP C 1000PF K		B
C60			CC73FCH1H470J	CHIP C 47PF J		
C61			CK73EB1H102K	CHIP C 1000PF K		
C101		*	CK73FB1E473M	CHIP C 0.047UF M		
C102			CK73FB1H223K	CHIP C 0.022UF K		
C103			CK73FB1E273K	CHIP C 0.027UF K		
C104			C90-0896-05	ELECTRO 47UF 16WV		
CN1			E40-5128-05	PIN CONNECTOR (20P)		
CN2			E40-5127-05	PIN CONNECTOR (7P)		
CN4			E40-5127-05	PIN CONNECTOR (7P)		
CN6			E40-5126-05	PIN CONNECTOR (7P)		
J1			E11-0421-05	PHONE JACK		
J2			E11-0420-15	PHONE JACK		
TP1 ,2			E23-0464-05	TERMINAL		
W2			E31-3295-15	CONNECTING WIRE		
W3			E31-3296-15	CONNECTING WIRE		B
W3		*	E31-3335-15	CONNECTING WIRE		A
W3		*	E31-3335-15	CONNECTING WIRE		C
-		*	F12-0411-04	SHIELDING PARTS(PLL)		
-		*	F20-0597-04	INSULATING BOARD(DRIVE)		
-			J30-0545-05	SPACER (X1,XF1,XF2)		
-		*	J30-0551-04	SPACER (POWER MODULE)		
L1 ,2			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		

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L3			L40-1892-16	SMALL FIXED INDUCTOR(1.8UH)		
L4		*	L34-1210-05	COIL		
L5		*	L34-1224-05	COIL		
L6 ,7			L34-0893-05	COIL		
L8			L40-1892-16	SMALL FIXED INDUCTOR(1.8UH)		
L9		*	L34-4051-05	COIL		
L10			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
X1		*	L77-1357-05	CRYSTAL RESONATOR (17.355MHZ		
XF1 ,2		*	L71-0276-05	MCF (16.9MHZ)		
R1			RK73FB2A124J	CHIP R 120K J 1/10W		
R2			RK73FB2A151J	CHIP R 150 J 1/10W		
R3			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R4			RK73FB2A334J	CHIP R 330K J 1/10W		
R5			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R6			RK73FB2A473J	CHIP R 47K J 1/10W		
R7			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R8 ,9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R10			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R11			RK73FB2A471J	CHIP R 470 J 1/10W		
R12			RK73FB2A100J	CHIP R 10 J 1/10W		
R13			RK73FB2A221J	CHIP R 220 J 1/10W		
R14			R92-0670-05	CHIP R 0 OHM		
R15			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R16			RK73FB2A471J	CHIP R 470 J 1/10W		
R17			RK73FB2A153J	CHIP R 15K J 1/10W		
R18			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R19			RD14BB2C101J	RD 100 J 1/6W		
R101			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R102			RK73FB2A104J	CHIP R 100K J 1/10W		
R103			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R104			RK73FB2A102J	CHIP R 1.0K J 1/10W		
VR5			R23-9403-05	POTENTIOMETER (10K/50K)AF,SQ		
W1			R92-1061-05	JUMPER REST 0 OHM		
W4			R92-1061-05	JUMPER REST 0 OHM		
D1			MI303	DIODE		
D2		*	HSK277	CHIP DIODE		
D4		*	DAN202U	CHIP DIODE		
IC1		*	M57796MA	IC(POWER MODULE/ 144-148MHZ)		
Q1			2SB1182(Q)	TRANSISTOR		
Q2			2SC2714(Q)	CHIP TRANSISTOR		
Q3			2SB1182(Q)	TRANSISTOR		
Q4		*	DTC143TU	DIGITAL TRANSISTOR		
Q5		*	DTC114EU	DIGITAL TRANSISTOR		
Q9			DTC143TK	DIGITAL TRANSISTOR		B
Q101		*	2SC4116(GR)	CHIP TRANSISTOR		
Z1		*	X59-3320-10	FRONT UNIT		
Z2		*	X58-3210-11	IF UNIT		
Z3		*	X59-3310-10	AF AMP UNIT		
Z4		*	X59-3300-10	MIC AMP UNIT		A
Z4		*	X59-3300-10	MIC AMP UNIT		B
Z4		*	X59-3300-61	MIC AMP UNIT		C
Z5		*	X59-3330-10	DRIVE UNIT		
Z6		*	X58-3220-10	APC UNIT		
Z7		*	X58-3200-10	AVR UNIT		

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Z8		*	X58-3230-10	PLL UNIT		
AVR UNIT (X58-3200-10)						
C1			CK73FB1H471K	CHIP C 470PF K		
C2			CK73FB1H103K	CHIP C 0.010UF K		
C3 ,4			CK73FB1H471K	CHIP C 470PF K		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			CK73FB1H471K	CHIP C 470PF K		
C8 ,9			CK73FB1H471K	CHIP C 470PF K		
C10 ,11			C92-0004-05	CHIP TAN 1UF 16WV		
C12			CK73FB1H471K	CHIP C 470PF K		
C13			CK73FB1H102K	CHIP C 1000PF K		
C14			CK73EB1E104K	CHIP C 0.10UF K		
C15			CK73FB1H471K	CHIP C 470PF K		
C16			CK73EB1E104K	CHIP C 0.10UF K		
C17			CK73FB1H471K	CHIP C 470PF K		
C18 -20			CK73FB1H102K	CHIP C 1000PF K		
C21 -23			CK73FB1H471K	CHIP C 470PF K		
C24			C92-0507-05	TANTAL 4.7UF 6.3WV		
C25 ,26			CK73FB1H471K	CHIP C 470PF K		
C27			C92-0501-05	CHIP TAN 1.5UF 6.3WV		
		*	E23-0610-05	TERMINAL		
L1 ,2		*	L92-0123-05	FERRITE BEAD		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A473J	CHIP R 47K J 1/10W		
R3			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R4			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R6			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R7			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8			RK73FB2A274F	CHIP R 270K F 1/10W		
R9		*	RK73FB2A124F	CHIP R 120K F 1/10W		
R10			RK73FB2A223J	CHIP R 22K J 1/10W		
R11			R92-0670-05	CHIP R 0 OHM		
R12			RK73FB2A183J	CHIP R 18K J 1/10W		
R13			R92-0679-05	CHIP R 0 OHM		
D1 ,2		*	MA110	CHIP DIODE		
IC1			LP2950CZ	IC(VOLTAGE REGULATOR/ +5V)		
IC2		*	IMX1	IC		
Q1		*	2SD1819	CHIP TRANSISTOR		
Q2			2SA1313(Y)	CHIP TRANSISTOR		
Q3		*	UN5119	DIGITAL TRANSISTOR		
Q4		*	DTC144EU	DIGITAL TRANSISTOR		
Q5		*	2SB1218	CHIP TRANSISTOR		
IF UNIT (X58-3210-11)						
C1			CK73EB1E104K	CHIP C 0.10UF K		
C2			C92-0004-05	CHIP TAN 1UF 16WV		
C3			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C4			CK73FB1E223K	CHIP C 0.022UF K		
C5 -8			CK73FB1H102K	CHIP C 1000PF K		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			C92-0001-05	CHIP TAN 0.1UF 35WV		
C13			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		

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C14			CC73FCH1H330J	CHIP C 33PF J		
C16			CC73FCH1H820J	CHIP C 82PF J		
C17 -19			CK73EB1E104K	CHIP C 0.10UF K		
C20			CC73FCH1H820J	CHIP C 82PF J		
C21			CK73FB1E223K	CHIP C 0.022UF K		
-			E23-0610-05	TERMINAL		
CD1		*	L79-0817-05	FILTER (CDBM455C7)		
CF1		*	L72-0362-05	CERAMIC FILTER (CFUM455E)		
R1			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R2			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R3			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R4			RK73FB2A274J	CHIP R 270K J 1/10W		
R5			RK73FB2A473J	CHIP R 47K J 1/10W		
R6			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R7			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R8			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R9			RK73FB2A561J	CHIP R 560 J 1/10W		
R10			RK73FB2A473J	CHIP R 47K J 1/10W		
R11			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R12			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R13			R92-0670-05	CHIP R 0 OHM		
R14			RK73FB2A681J	CHIP R 680 J 1/10W		
R15			RK73FB2A101J	CHIP R 100 J 1/10W		
TH1		*	R92-0680-05	FIXED RESISTOR (ERS-M33J752U)		
VR1			R12-4419-05	TRIMMING POT. (68K)		
D1			HSM88AS	CHIP DIODE		
IC1		*	TK10487MT1(B,C)	IC		
Q1			2SC2712(GR)	CHIP TRANSISTOR		
APC UNIT (X58-3220-10)						
C1 ,2			CK73FB1H471K	CHIP C 470PF K		
C3			CC73FCH1H151J	CHIP C 150PF J		
C4			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C5 ,6			CK73FB1H471K	CHIP C 470PF K		
-			E23-0610-05	TERMINAL		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A223J	CHIP R 22K J 1/10W		
R3			RK73FB2A683J	CHIP R 68K J 1/10W		
R4		*	R92-1203-05	CHIP R 0.22 J 1/2W		
R5			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R6			RK73FB2A124J	CHIP R 120K J 1/10W		
R7			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R8			RK73FB2A103J	CHIP R 10K J 1/10W		
R9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
VR1		*	R12-1439-05	TRIMMING POT. (4.7K)		
VR2		*	R12-3461-05	TRIMMING POT. (10K)		
D1			02CZ3.9YZ	CHIP ZENER DIODE		
D2			1SS268	CHIP DIODE		
IC1			LM301AD	IC(OP AMP)		
Q1			2SA1162(Y)	CHIP TRANSISTOR		
Q2			DTC114YK	DIGITAL TRANSISTOR		
TH1		*	159-101-83052	THERMISTER (100)		

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PLL UNIT (X58-3230-10)						
C1			CC73FCH1H180J	CHIP C 18PF J		
C2			CC73FCH1H100D	CHIP C 10PF D		
C3			CK73FB1H102K	CHIP C 1000PF K		
C4 ,5			CC73FCH1H100D	CHIP C 10PF D		
C6 ,7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H070D	CHIP C 7.0PF D		
C9			CC73FCH1H100J	CHIP C 10PF J		
C10 ,11			CC73FCH1H070D	CHIP C 7.0PF D		
C12			CC73FCH1H180J	CHIP C 18PF J		
C13			CC73FCH1H270J	CHIP C 27PF J		
C14			CC73FCH1H010C	CHIP C 1.0PF C		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			C92-0003-05	CHIP TAN 0.47UF 25WV		
C17			CK73EB1E104K	CHIP C 0.10UF K		
C18			CK73FB1E103K	CHIP C 0.010UF K		
C19			C92-0003-05	CHIP TAN 0.47UF 25WV		
C20			CC73FCH1H100D	CHIP C 10PF D		
C51 -54			CK73FB1H102K	CHIP C 1000PF K		
C55			CC73FCH1H150J	CHIP C 15PF J		
C56			CC73FCH1H560J	CHIP C 56PF J		
C57			CK73FB1H223K	CHIP C 0.022UF K		
C58			CC73FCH1H101J	CHIP C 100PF J		
C59			CK73FB1E103K	CHIP C 0.010UF K		
C60			CK73FB1H471K	CHIP C 470PF K		
C61			CK73FB1E103K	CHIP C 0.010UF K		
C62			C92-0004-05	CHIP TAN 1UF 16WV		
C63			CK73FB1H182K	CHIP C 1800PF K		
TC1 ,2			C05-0346-05	TRIMMING CAP (6PF)		
TC51			C05-0345-05	TRIMMING CAP (10PF)		
CN1			E40-5130-05	PIN CONNECTOR		
CN51			E40-5129-05	PIN CONNECTOR		
-			F10-1367-04	SHIELDING PLATE		
-		*	F11-1095-03	SHIELDING COVER		
-			F20-0591-04	INSULATING BOARD		
L1		*	L34-2305-05	COIL		
L2		*	L34-4084-05	COIL		
X51			L77-1358-05	CRYSTAL RESONATOR(12.8MHZ)		
R1			RK73FB2A471J	CHIP R 470 J 1/10W		
R2			RK73FB2A104J	CHIP R 100K J 1/10W		
R3			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A473J	CHIP R 47K J 1/10W		
R6 ,7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8 ,9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R10			RK73FB2A184J	CHIP R 180K J 1/10W		
R11			RK73FB2A104J	CHIP R 100K J 1/10W		
R12 ,13			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R14 ,15			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R16			RK73FB2A183J	CHIP R 18K J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R51			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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R54 ,55			RK73FB2A104J	CHIP R 100K J 1/10W		
R56 ,57			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		
D1 ,2			MA344B	CHIP DIODE		
D3		*	MA862	CHIP DIODE		
IC51			M54959FP	IC(FREQ SYNTHESIZER PLL)		
Q1 ,2			2SC2714(Y)	CHIP TRANSISTOR		
Q3			FMG4	DIGITAL TRANSISTOR		
Q4		*	IMX5	DIGITALTRANSISTOR		
Q51			2SC2714(Y)	CHIP TRANSISTOR		
Q52			XN6501	DIGITAL TRANSISTOR		
MIC AMP UNIT (X59-3300-XX) -10:TH-25A TH-25AT -61:TH-25E						
C1 ,2			CK73FB1E473M	CHIP C 0.047UF M		C
C3			CK73FB1E223K	CHIP C 0.022UF K		
C4			CK73FB1H471K	CHIP C 470PF K		
C5			C92-0002-05	CHIP TAN 0.22UF 35WV		
C6			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FSL1H151J	CHIP C 150PF J		
C9			CK73FB1H182K	CHIP C 1800PF K		
C10			C92-0507-05	TANTAL 4.7UF 6.3WV		
C11			CK73FB1H103K	CHIP C 0.010UF K		
C13			CK73FB1H471K	CHIP C 470PF K		
C14			C92-0507-05	TANTAL 4.7UF 6.3WV		
C15			CK73FB1H103K	CHIP C 0.010UF K		
-			E23-0610-05	TERMINAL		
R1			RK73FB2A183J	CHIP R 18K J 1/10W		C
R2			RK73FB2A684J	CHIP R 680K J 1/10W		C
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R5			R92-0679-05	CHIP R 0 OHM		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8			RK73FB2A154J	CHIP R 150K J 1/10W		C
R8			RK73FB2A823J	CHIP R 82K J 1/10W		A
R8			RK73FB2A823J	CHIP R 82K J 1/10W		B
R9			RK73FB2A104J	CHIP R 100K J 1/10W		
R10			RK73FB2A391J	CHIP R 390 J 1/10W		
R11			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R12			RK73FB2A223J	CHIP R 22K J 1/10W		
R13			RK73FB2A273J	CHIP R 27K J 1/10W		
R14			RK73FB2A104J	CHIP R 100K J 1/10W		
R15			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R16			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R17			RK73FB2A563J	CHIP R 56K J 1/10W		
R18			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R19			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R20			R92-0679-05	CHIP R 0 OHM		
R21			R92-0670-05	CHIP R 0 OHM		
VR1		*	R12-6407-05	TRIMMING POT. (470K)		
IC1			NJM4560M	IC(OP AMP X2)		
TH1		*	159-252-83003	THERMISTER (2.5K)		

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AF AMP UNIT (X59-3310-10)								
C1			CK73FB1H102K	CHIP C	1000PF	K		
C2			CK73FB1H103K	CHIP C	0.010UF	K		
C3			CK73FB1E473M	CHIP C	0.047UF	M		
C4			C92-0501-05	CHIP TAN	1.5UF	6.3WV		
C5			CK73FB1H102K	CHIP C	1000PF	K		
C6			CK73FB1E473M	CHIP C	0.047UF	M		
C7			CK73FB1H103K	CHIP C	0.010UF	K		
C8			C92-0004-05	CHIP TAN	1UF	16WV		
-			E23-0610-05	TERMINAL				
R1			RK73FB2A222J	CHIP R	2.2K	J 1/10W		
R2			RK73FB2A473J	CHIP R	47K	J 1/10W		
R3			RK73FB2A273J	CHIP R	27K	J 1/10W		
R4			RK73FB2A331J	CHIP R	330	J 1/10W		
R5			RK73FB2A100J	CHIP R	10	J 1/10W		
R6			RK73FB2A103J	CHIP R	10K	J 1/10W		
D1			02CZ6.8X	CHIP ZENER DIODE				
IC1		*	NJM386BM	IC(OP AMP)				
Q1		*	2SB1182(F5)Q	CHIP TRANSISTOR				
Q2			2SC2712(GR)	CHIP TRANSISTOR				
Q3			DTC144EK	DIGITAL TRANSISTOR				
FRONT-END UNIT (X59-3320-10)								
C1			CK73FB1H102K	CHIP C	1000PF	K		
C2			CC73FCH1H101J	CHIP C	100PF	J		
C3 -5			CK73FB1H102K	CHIP C	1000PF	K		
C6			CC73FCH1H090D	CHIP C	9.0PF	D		
C7			CC73FCH1H020C	CHIP C	2.0PF	C		
C8			CC73FCH1HR50C	CHIP C	0.50PF	C		
C9			CC73FCH1H090D	CHIP C	9.0PF	D		
C10			CC73FCH1H030C	CHIP C	3.0PF	C		
C11			CC73FCH1HR50C	CHIP C	0.50PF	C		
C12			CC73FCH1H090D	CHIP C	9.0PF	D		
C13			CC73FCH1H020C	CHIP C	2.0PF	C		
C14			CK73FB1E103K	CHIP C	0.010UF	K		
C15			CK73FB1H102K	CHIP C	1000PF	K		
C16			CK73FB1E223K	CHIP C	0.022UF	K		
C17			CC73FPH1H390J	CHIP C	39PF	J		
C18			CC73FCH1H030C	CHIP C	3.0PF	C		
C19			CC73FCH1H100D	CHIP C	10PF	D		
C20 ,21			CK73FB1H102K	CHIP C	1000PF	K		
-			E23-0610-05	TERMINAL				
L1		*	L34-2307-15	COIL				
L2 -4		*	L34-4052-05	COIL				
L5			L40-4772-80	SMALL FIXED INDUCTOR (47NH)				
R1 ,2			RK73FB2A103J	CHIP R	10K	J 1/10W		
R3			RK73FB2A221J	CHIP R	220	J 1/10W		
R4			RK73FB2A103J	CHIP R	10K	J 1/10W		
R5			RK73FB2A470J	CHIP R	47	J 1/10W		
R6			RK73FB2A101J	CHIP R	100	J 1/10W		
R7			RK73FB2A561J	CHIP R	560	J 1/10W		
R8			RK73FB2A470J	CHIP R	47	J 1/10W		

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R9			RK73FB2A103J	CHIP R 10K J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11		*	R90-0702-05	MULTI-COMP (100KX4)		
R12			RK73FB2A222J	CHIP R 2.2K J 1/10W		
D1			HSM88AS	CHIP DIODE		
D2		*	DAP202U	CHIP DIODE		
D3		*	MA344B	CHIP DIODE		
Q1		*	2SC3937	CHIP TRANSISTOR		
Q2		*	2SC4215(Y)	CHIP TRANISISTOR		
Q3		*	2SK302(Y)	CHIP FET		
DRIVE UNIT (X59-3330-10)						
C1 -3			CK73FB1H102K	CHIP C 1000PF K		
C4			CC73FCH1H150J	CHIP C 15PF J		
C5 -7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H120J	CHIP C 12PF J		
-			E23-0610-05	TERMINAL		
L1 ,2			L40-6872-80	SMALL FIXED INDUCTOR (68NH)		
R1			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3			RK73FB2A101J	CHIP R 100 J 1/10W		
R4			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R5			RK73FB2A560J	CHIP R 56 J 1/10W		
R6			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R7			RK73FB2A470J	CHIP R 47 J 1/10W		
R8			RK73FB2A150J	CHIP R 15 J 1/10W		
R9			RK73FB2A120J	CHIP R 12 J 1/10W		
R10			R92-0670-05	CHIP R 0 OHM		
D1			1SS268	CHIP DIODE		
D2			1SS226	CHIP DIODE		
Q1			2SC2714(Y)	CHIP TRANSISTOR		
Q2			2SC2954	CHIP TRANSISTOR		

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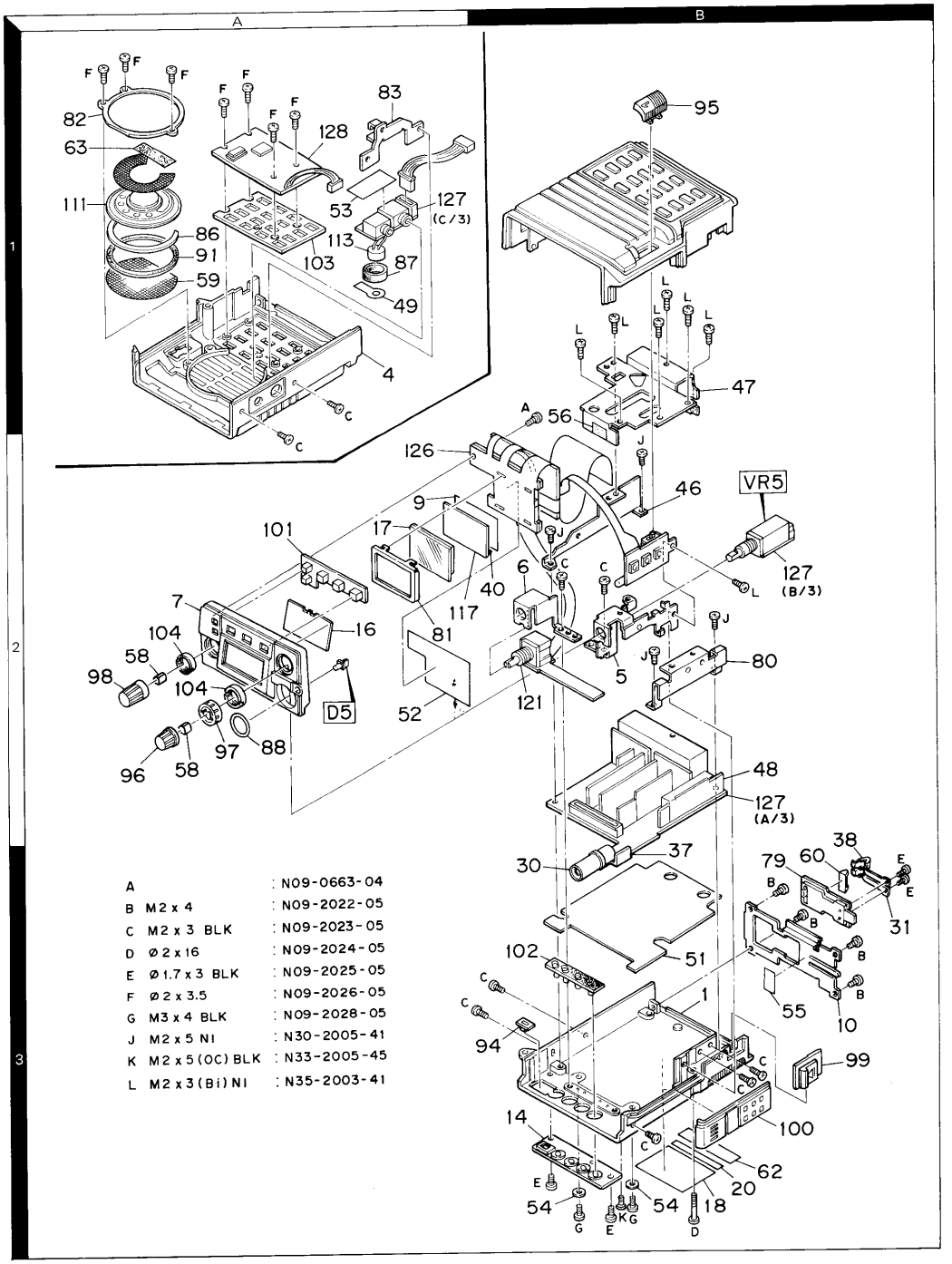
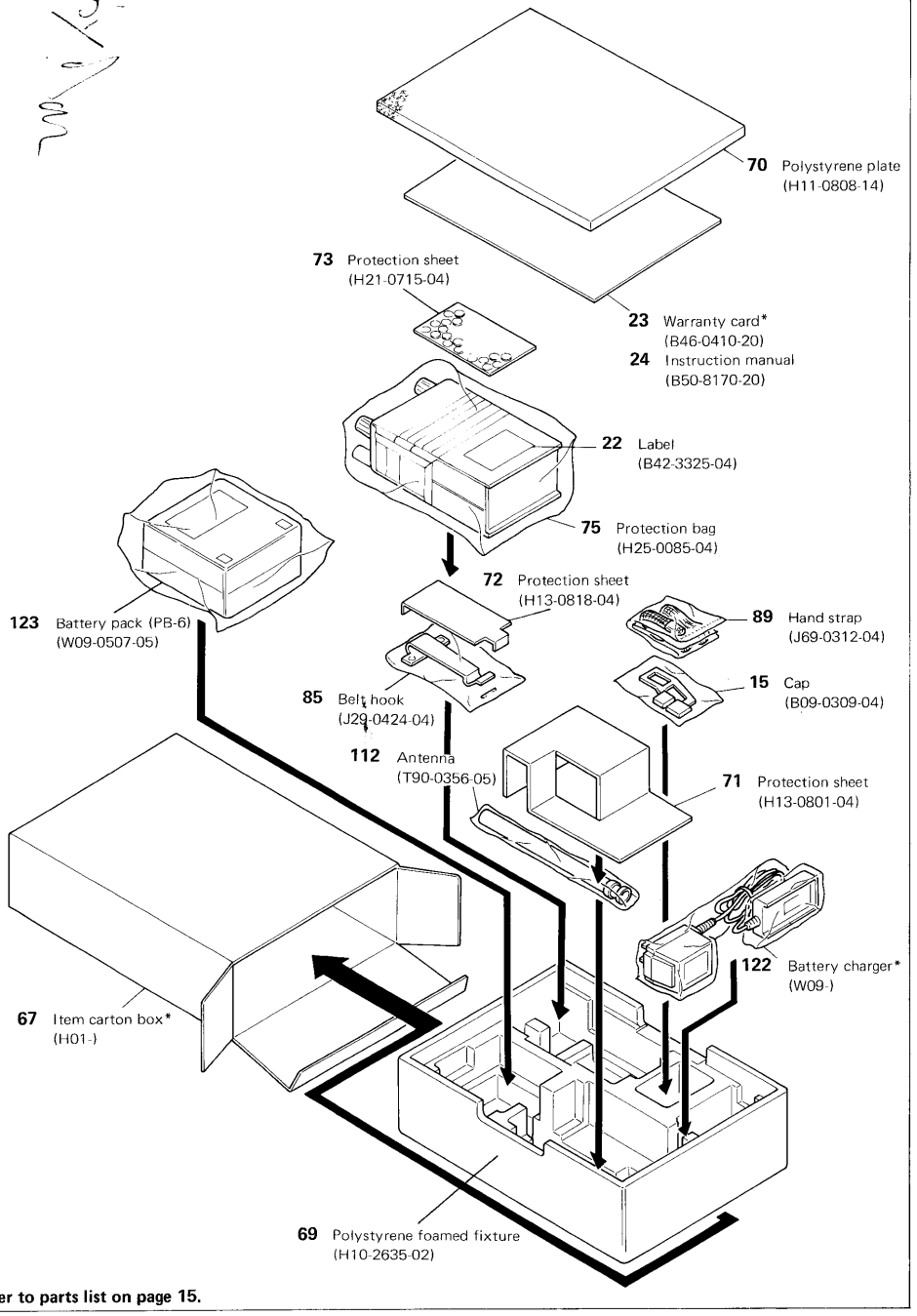
DISASSEMBLY



A		: N09-0663-04
B	M2 x 4	: N09-2022-05
C	M2 x 3 BLK	: N09-2023-05
D	Ø2 x 16	: N09-2024-05
E	Ø1.7 x 3 BLK	: N09-2025-05
F	Ø2 x 3.5	: N09-2026-05
G	M3 x 4 BLK	: N09-2028-05
J	M2 x 5 NI	: N30-2005-41
K	M2 x 5 (OC) BLK	: N33-2005-45
L	M2 x 3 (Bi) NI	: N35-2003-41

PACKING



* Refer to parts list on page 15.

ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. Stabilized Power Supply
1) The supply voltage can be changed between 5V and 18V, and the current is 3A or more.
2) The standard voltage is 12.0V.

2. DC Ammeter
1) Class 1 ammeter (17 ranges and other features)
2) The full scale can be set to either 300mA or 3A.
3) A cable of less internal loss must be used.

3. Frequency Counter (f. counter)
1) Frequencies of up to 1GHz or so can be measured.
2) The sensitivity can be changed to 250MHz or below, and measurements are highly stable and accurate (0.2 ppm or so).

4. Power Meter
1) Measurable frequency : Up to 500MHz
2) Impedance : 50Ω, unbalanced
3) Measuring range : Full scal of 10W or so
4) A standard cable (5D2W 1m) must be used.

5. RF VTVM (RF V.M)
1) Measurable frequency : Up to 500MHz or so

6. Linear Detector
1) Measurable frequency : Up to 500MHz
2) Characteristics are flat, and CN is 60dB or more.

7. Digital Voltmeter
1) Voltage range : FS = 18V or so
2) Input resistance : 1MΩ or more

8. Oscilloscope
1) Measuring range : DC to 30MHz
2) Provides highly accurate measurments for 5 to 25 MHz.

9. AF Voltmeter (AF VTVM)
1) Measurable frequency : 50Hz to 1MHz
2) Maximum sensitivity : 1mV or more

10. Spectrum Analyzer
1) Measuring range : DC to 1GHz or more

11. Standard Signal Generator (SSG)
1) Maximum frequency : 500MHz or more
2) Output : −20dB/0.1μV to 120dB/1V
3) Output impedance : 50Ω

12. Tracking Generator
1) Center frequency : 50kHz to 500MHz
2) Frequency deviation : ±35MHz
3) Output voltage : 100mV or more

13. Dummy Load
1) 8Ω, 3W or more

PREPARATION

- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

  POWER/VOL . . . . . ON
  SQL VR . . . . . MIN
  F.LOCK . . . . . OFF
  HI/LOW . . . . . HI

- Use a non-conductive rod such as a Bakelite rod for adjustment (especially of trimmers and coils).
- To protect the SSG, do not send out signals while adjusting the receiving unit.
- The indicated SSG output levels are for maximum output.

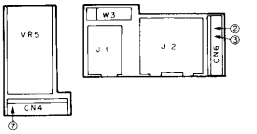
ADJUSTMENT

RESET

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reset	1) POWER SW : OFF							
	2) Hold down [M] key POWER SW : ON						Unit reset.	Display 144.000

TX-RX COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Voltage check	1) Power supply voltage : 12V (External)	DC V.M	TX-RX (B/3)	CN4-7			Check	12V
	2) 5M		TX-RX (C/3)	CN6-3				5V
	3) 5T PTT : ON			CN6-2				5V

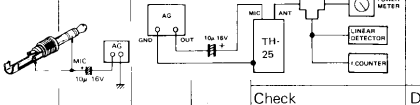


PLL ADJUSTMENT

Item		Condition	Measurement			Adjustment			Specifications/Remarks
			Test equipment	Unit	Terminal	Unit	Parts	Method	
1. Reference frequency		1) FREQ. : 146.000MHz **K,M,M2,M3,M4,X** FREQ. : 144.950MHz **T,W** PTT : ON	f. counter Power meter		ANT	PLL	TC51	146.000MHz **K,M,M2,M3,M4,X** 144.950MHz **T,W**	±100Hz
2. VCO	RX	1) FREQ. : 145.990MHz	DC V.M Power meter	TX-RX (A/3)	TP1	PLL	L1	2.4V	±0.2V
	TX	2) FREQ. : 145.990MHz PTT : ON					L2	2.4V	±0.2V

TX ADJUSTMENT

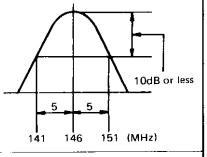
Item	Condition	Measurement			Adjustment			Specifications /Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
1. Power adjustment (Repeat 2 ~ 3 times.)	1) FREQ. : 147.995MHz **K,M,M2,M3,M4,X** FREQ. : 145.975MHz **T,W** HI/LOW : HI PTT : ON	Power meter Ammeter		ANT	APC	VR1	MAX.	5.5W or more.
	2) HI/LOW : LOW						500mW	±50mW Power consumption : 500mA or less.
	3) HI/LOW : HI					VR2	5.3W	Power consumption 1.2A or less.
2. DEV	1) FREQ. : 146.000MHz **K,M,M2,M3,M4,X** FREQ. : 144.950MHz **T,W** AG : 1kHz, 80mV **K,M,M2,M3,M4,X** AG : 1kHz, 40mV **T,W** PTT : ON	Power meter AG Linear detector f. counter		ANT	MIC AMP	VR3	±4.2kHz	±200Hz
	2) AG : 1kHz, 8mV **K,M,M2,M3,M4,X** AG : 1kHz, 4mV **T,W** PTT : ON						Check	DEV : ±3kHz ± 700Hz



ADJUSTMENT

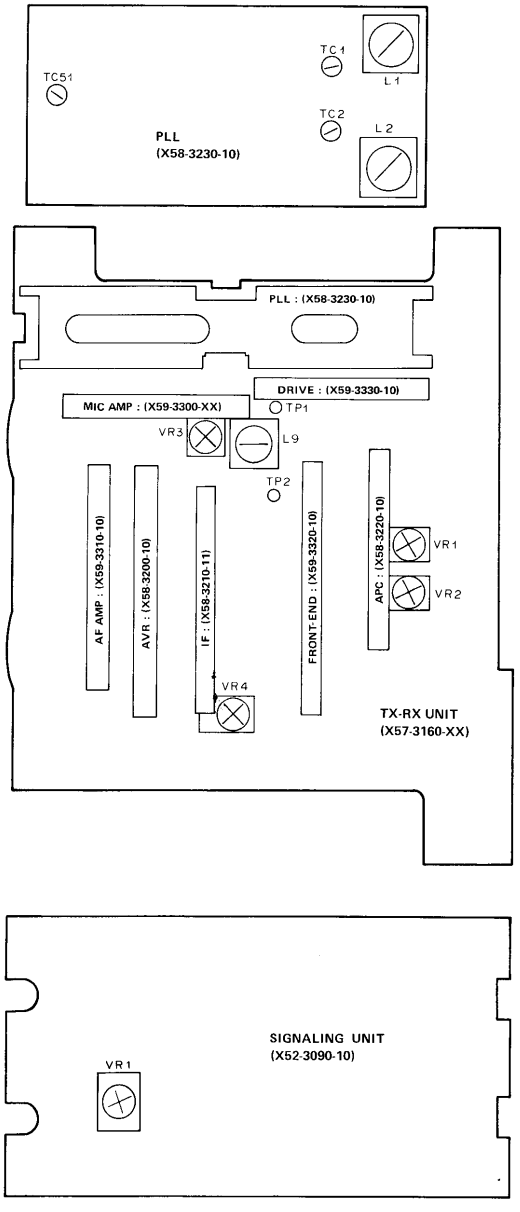
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
3. TONE **TH-25E only**	1) FREQ. : 144.950MHz TONE : ON **T** TONE : Push **W**	Power meter Linear detector Oscillo-scope		ANT			Check	±2.5 ~ ±4.5kHz
4. DTMF **TH-25AT only**	1) FREQ. : 146.000MHz PTT : ON Key board : [A] , [B] push	Power meter Linear detector f. counter		ANT	Signal-ing	VR1	DEV : ±3kHz	±200Hz
							Check	FREQ. : 1633Hz +20Hz, −10Hz
	2) Keyboard : [2] , [3] push	Oscillo-scope						DEV : ±0.7kHz ~ ±1.7kHz

RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reception sensitivity	1) Tracking generator output : −40dBm	T.G.		ANT			Check	
		Spectrum analyzer	TX-RX	TP2				
	2) FREQ. : 146.040MHz **K,M,M2,M3,M4,X** FREQ. : 145.050MHz **T,W** SSG output : 500μV/−47dBm MOD : 1kHz DEV : 3kHz	Oscillo-scope AF V.M Distortion meter SSG		EXT.SP	TX-RX (A/3)	L9	Adjust L9 to the minimum distortion.	5% or less.
	3) AF VR : MAX						Check	1.6V or more
	4) SSG output : 0.18μV/−116dBm						Check	12dB SINAD or more
	5) FREQ. : 144.040MHz **K,M,M2,M3,M4,X** FREQ. : 144.050MHz **T,W**							
2. S-meter	1) FREQ. : 146.040MHz **K,M,M2,M3,M4,X** FREQ. : 145.050MHz **T,W** SSG output : 3.95μV/−89dBm	S-meter			IF	VR4	Adjust VR4 that the 6th segment is turned off.	" ▬ ▬ " is one pair.
	2) SSG output : 5μV/−87dBm						Check	All segment light on.
	3) SSG output : 0.08μV/−123dBm							All segment light off.

ADJUSTMENT

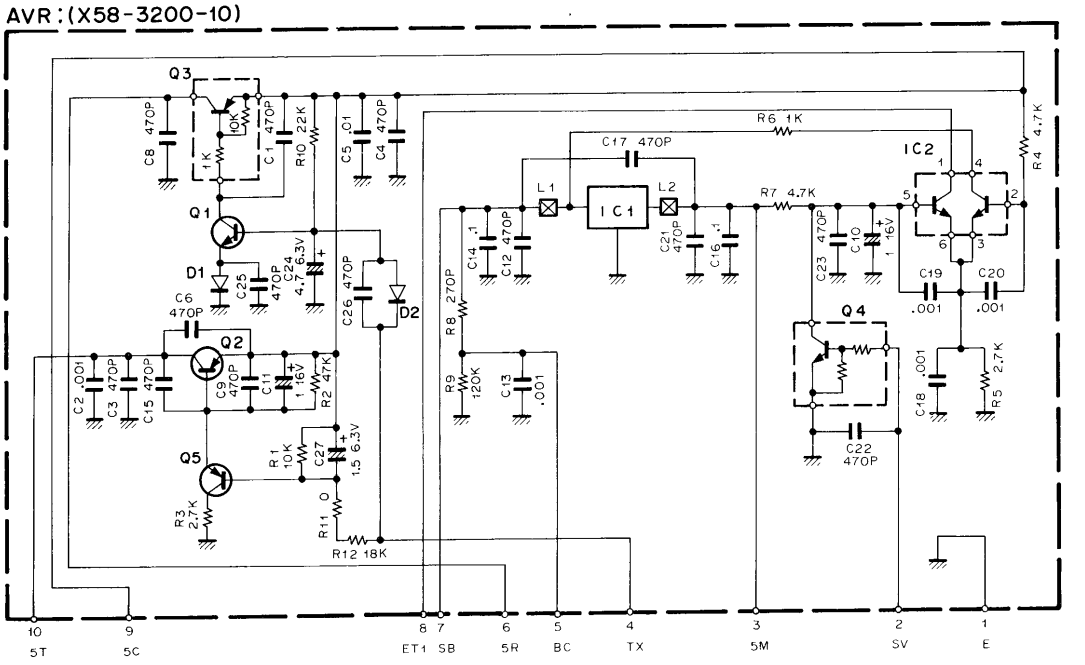
Adjusting point



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

AVR UNIT (X58-3200-10)

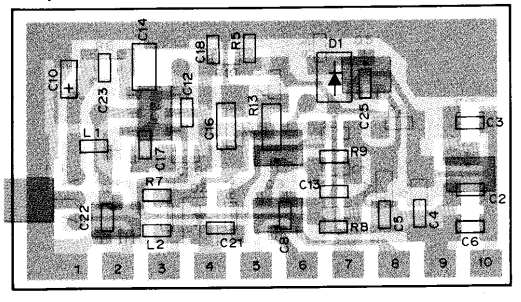
AVR : (X58-3200-10)



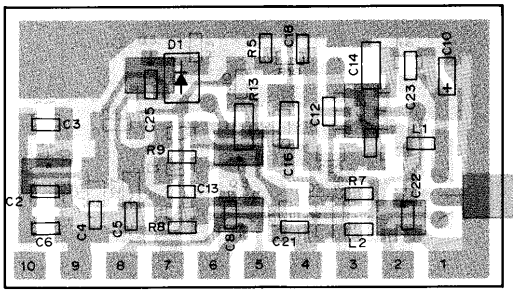
Q1 : 2SD1819 IC1 : LP2950CZ D1,2 : MA110
Q2 : 2SA1313(Y) IC2 : IMX1
Q3 : DTA113ZU or UN5119
Q4 : DTC144EU
Q5 : 2SB1218

: Component side
: Foil side

Component side view

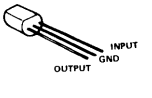


Foil side view



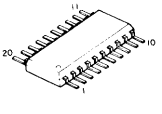
2SA1313(Y)
2SB1218
2SC2712(GR)
2SD1819
DTC144EU
UN5119

LP2950CZ



IMX1

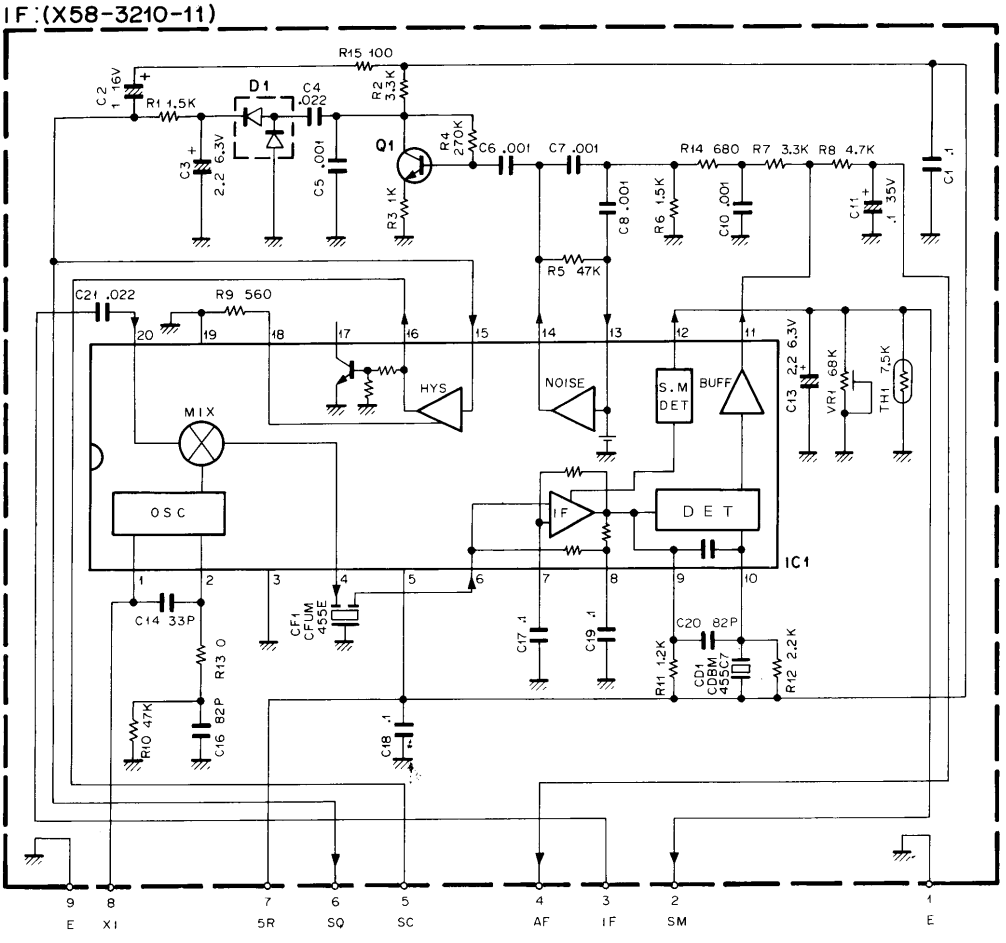
TK10487MT1(B,C)



PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

IF UNIT (X58-3210-11)

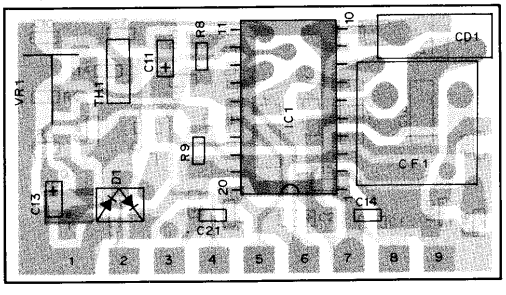
IF:(X58-3210-11)



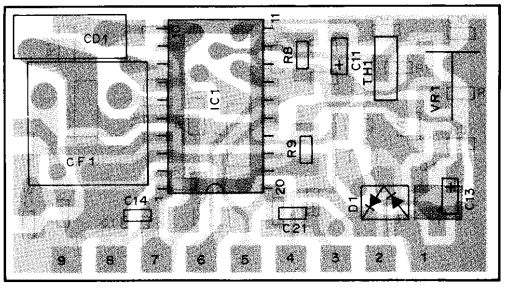
Q1 : 2SC2712(GR) D1 : HSM88AS
IC1 : TK10487MTI(B,C)

: Component side
: Foil side

Component side view



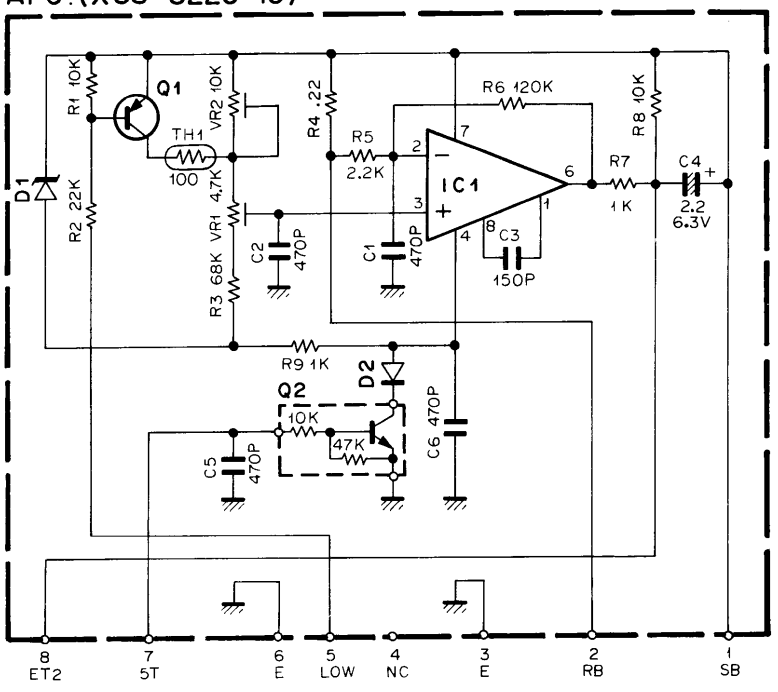
Foil side view



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

APC UNIT (X58-3220-10)

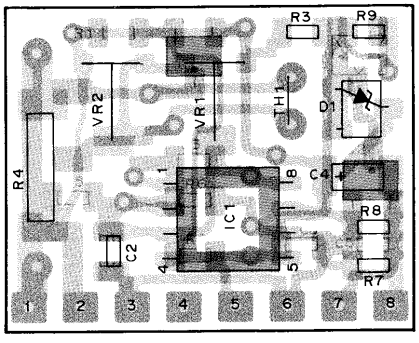
APC : (X58-3220-10)



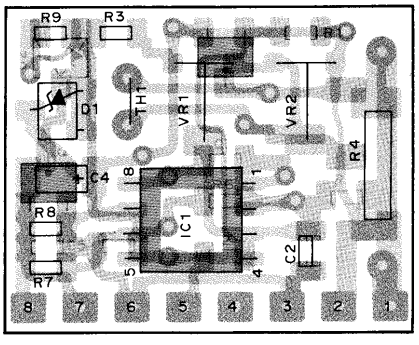
Q1 : 2SA1162(Y)
Q2 : DTC114YK
D1 : 0C2Z3.9Y,Z
D2 : 1SS268
IC1 : LM301AD

: Component side
: Foil side

Component side view



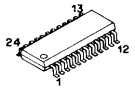
Foil side view



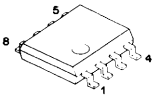
2SA1162(Y)
2SC2714(Y)
DTC114YK

FMG4
IMX5

M54959FP



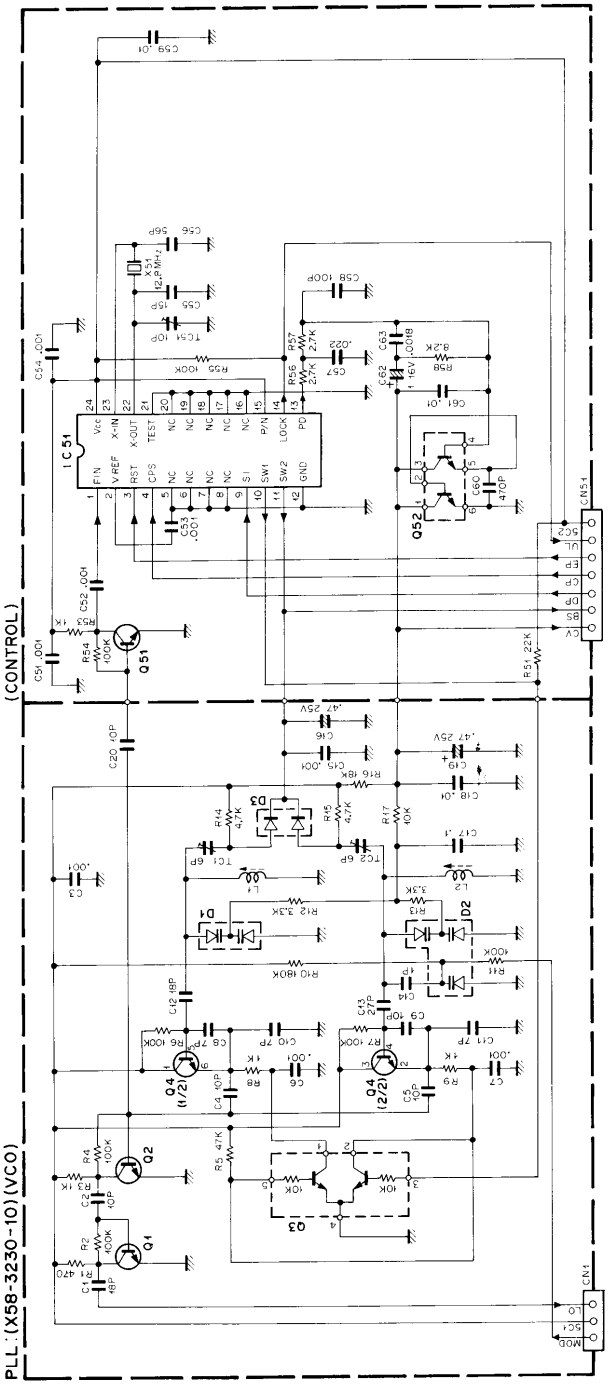
LM301AD



XN6501

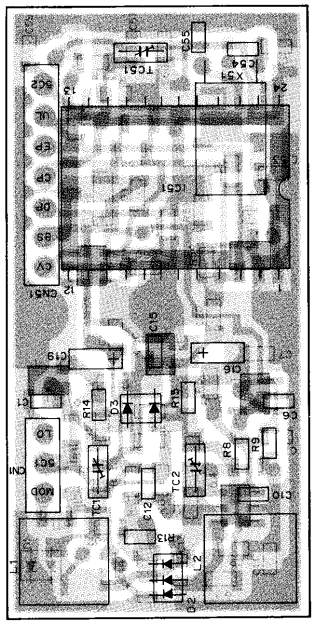
PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

PLL UNIT (X58-3230-10)

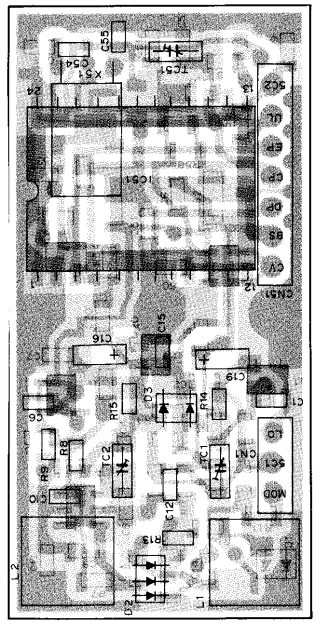


Q1,2,51 : 2SC2714(Y)
Q3 : FMG4
Q4 : 1MX5
Q52 : XN6501
IC51 : M54959FP
D1,2 : MA3448
D3 : MA862

: Component side
: Foil side



Foil side view

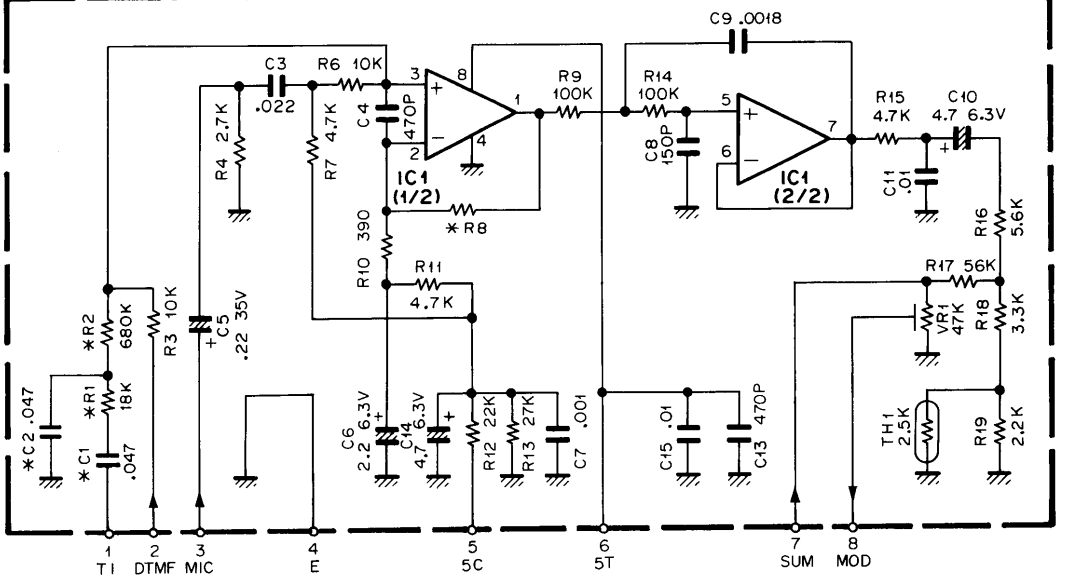


Component side view

TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

MIC AMP UNIT (X59-3300-XX) -10 : TH-25A/AT -61 : TH-25E

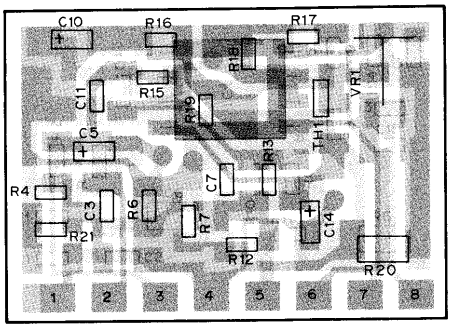
MIC AMP : (X59-3300-XX) -10 : TH-25A/AT -61 : TH-25E



	C1,2	R1,2	R8
-10	X	X	82K
-61	O	O	150K

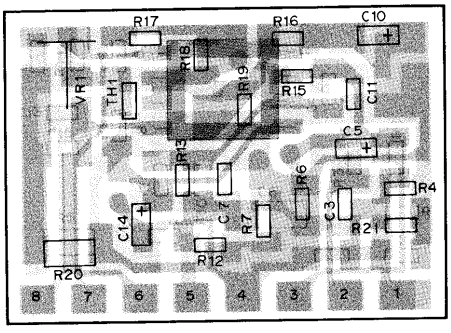
IC1 : NJM4560

Component side view



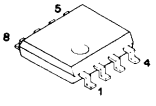
: Component side
: Foil side

Foil side view

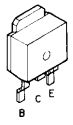


2SC2712(GR)
DTC144EK

NJM386BM
NJM4560



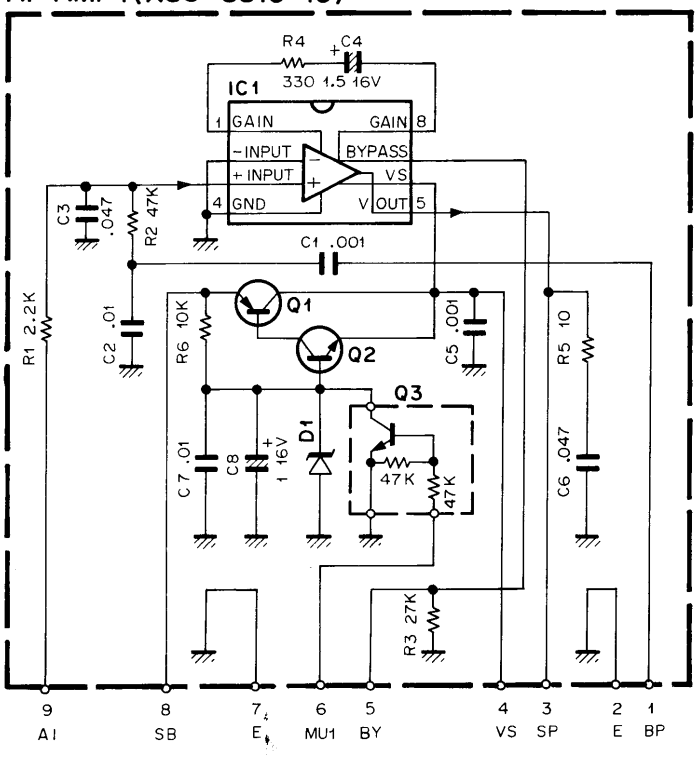
2SB1182(F5)Q



PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

AF AMP UNIT (X59-3310-10)

AF AMP : (X59-3310-10)



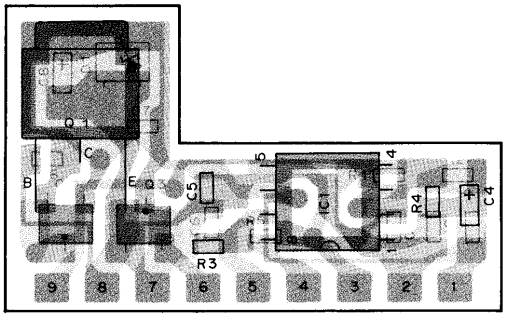
Q1 : 2SB1182(F5)Q
Q2 : 2SC2712(GR)
Q3 : DTC144EK

IC1 : NJM386BM

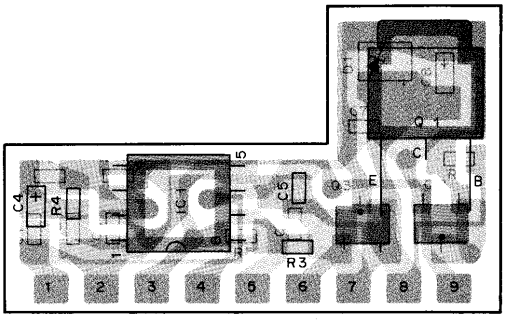
D1 : 02CZ6.8X or
RD6.8M-B1

: Component side
: Foil side

Component side view



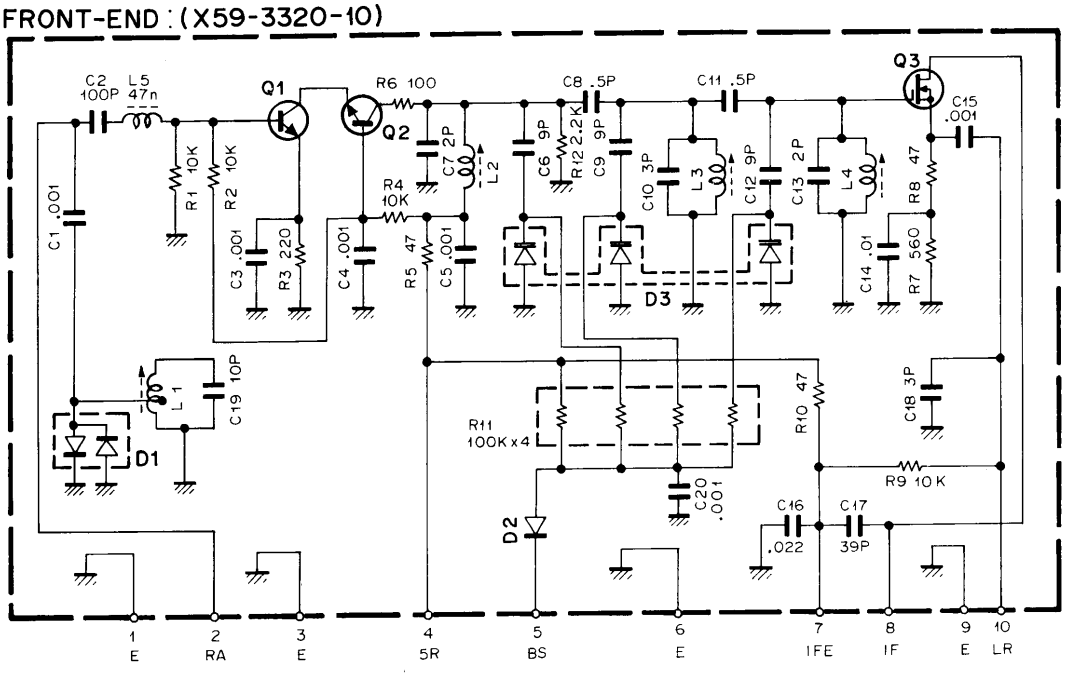
Foil side view



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

FRONT-END UNIT (X59-3320-10)

FRONT-END : (X59-3320-10)

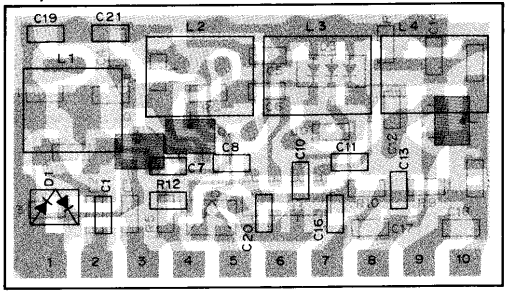


Q1 : 2SC3937
Q2 : 2SC4215(Y)
Q3 : 2SK302(Y)

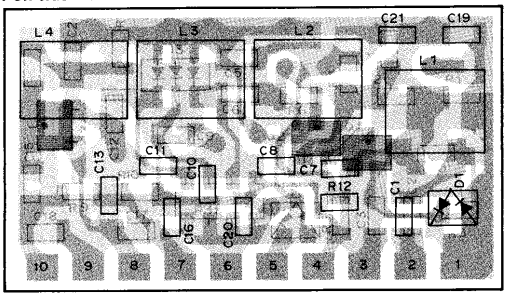
D1 : HSM88AS
D2 : DAP202U
D3 : MA344B

: Component side
: Foil side

Component side view

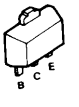


Foil side view



2SC2714(Y)
2SC3937
2SC4215(Y)

2SC2954

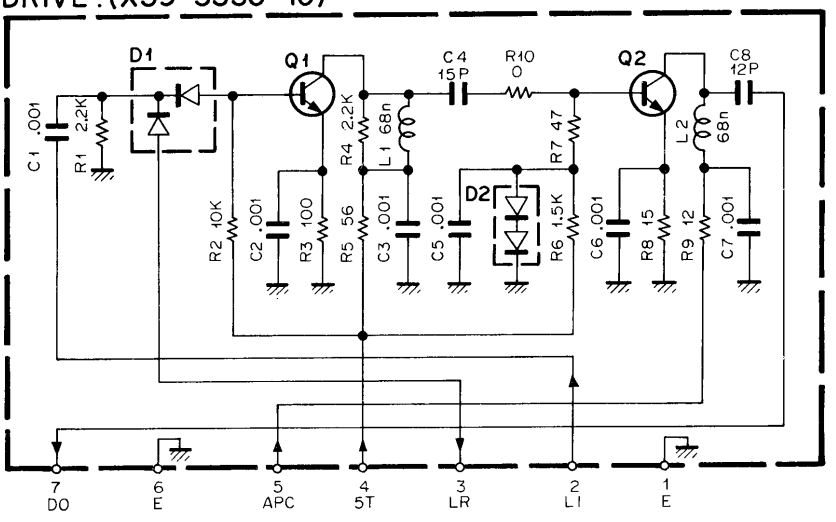


2SK302(Y)

PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

DRIVE UNIT (X59-3330-10)

DRIVE : (X59-3330-10)

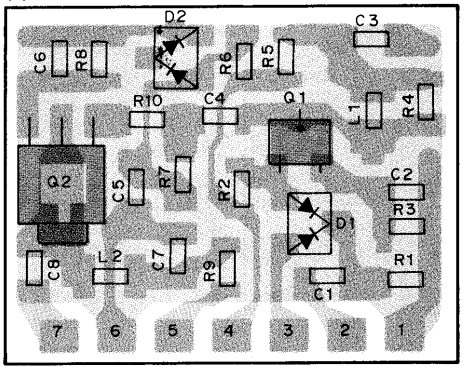


Q1 : 2SC2714(Y)
Q2 : 2SC2954

D1 : 1SS268
D2 : 1SS226

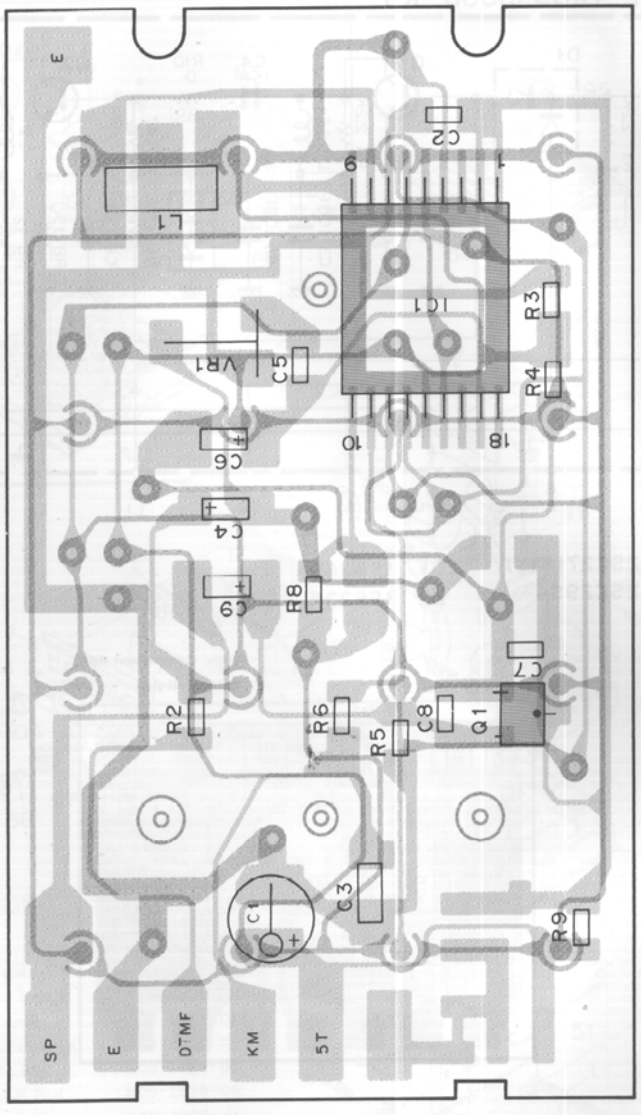
: Component side
: Foil side

Foil side view



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

SIGNALING UNIT (X52-3090-10) : TH-25AT Component side view



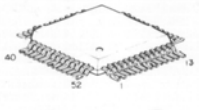
IC1 : LR40872 Q1 : 2SC2712(GF)

: Component side

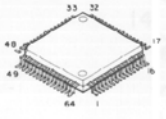
: Foil side

2SA1162(Y)
2SC2712(GR)
2SC2712(Y)

LH5008TP

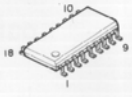


75108AG-018-22

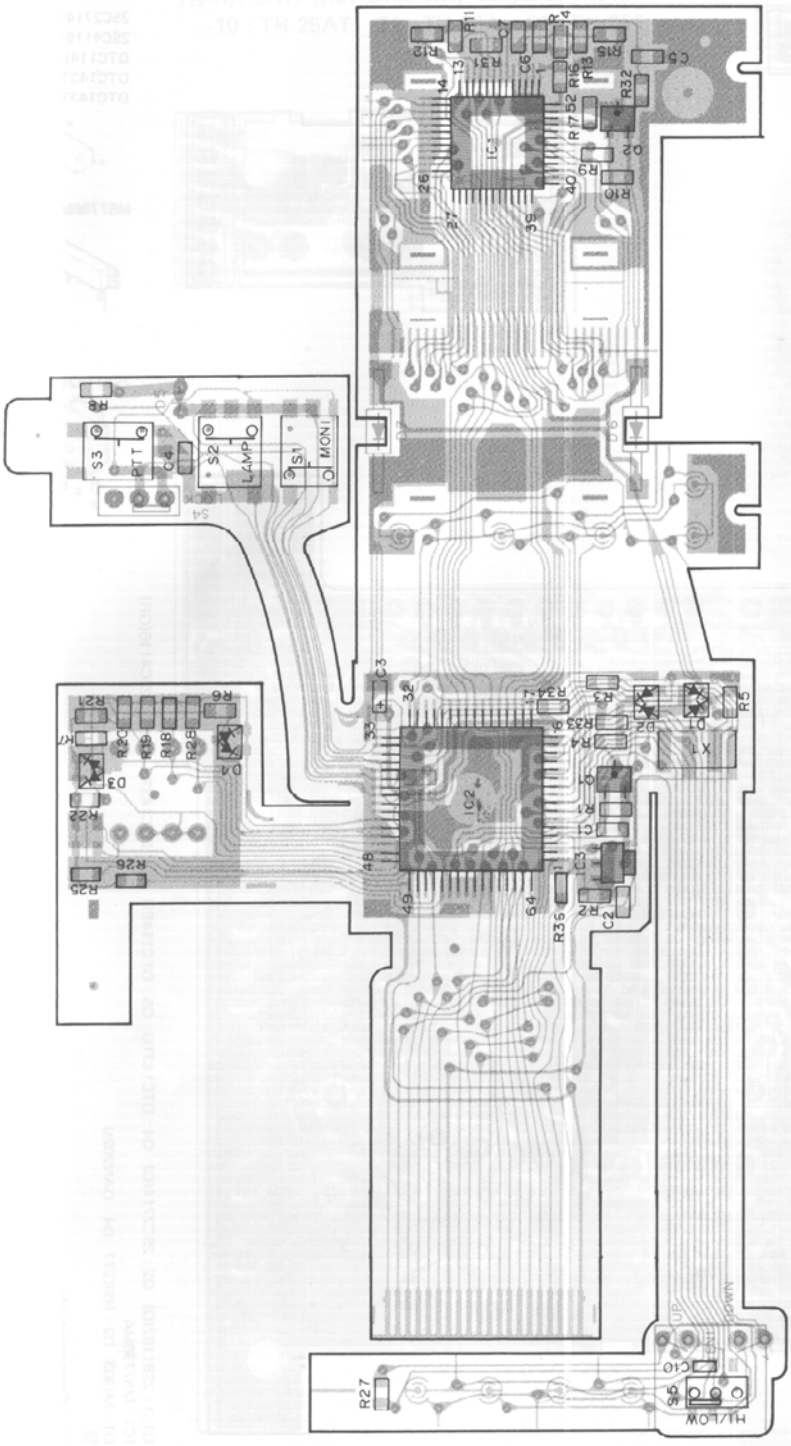


S8054ALR-LN

LR40872



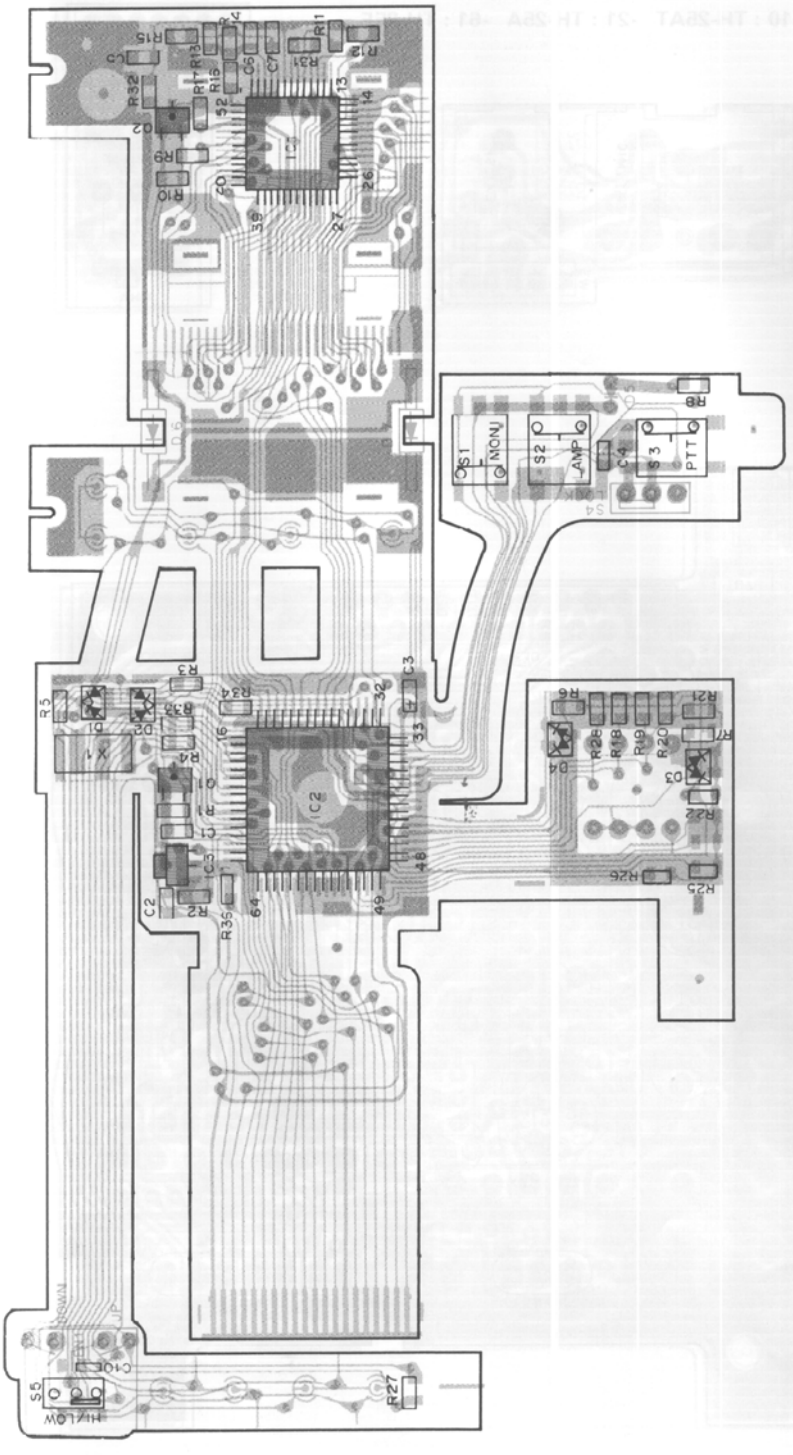
CONTROL UNIT (X53-3080-XX) -11 : TH25AT(K) -12 : TH-25AT(M,M2) TH-25A(M,M2) -23 : TH-25A(M3,M4,X) -52 : TH-25E(T) -62 : TH-25E(W) Component side view



: Component side
: Foil side

C1 : 2SC2712(Y) Q2 : 2SA1162(Y)
IC1 : LH5008TP IC2 : 75108AG-018-22 (T,W), 75108AG-021-22 (K,M,M2,M3,M4,X)
IC3 : S8054ALR-LN
D1,2 : 1SS184 D3,4 : 1SS181

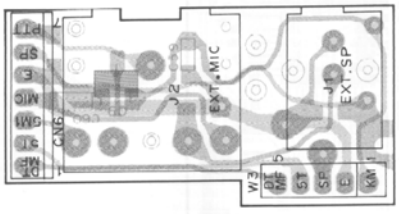
CONTROL UNIT (X53-3080-XX) Foil side view

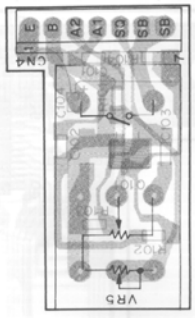


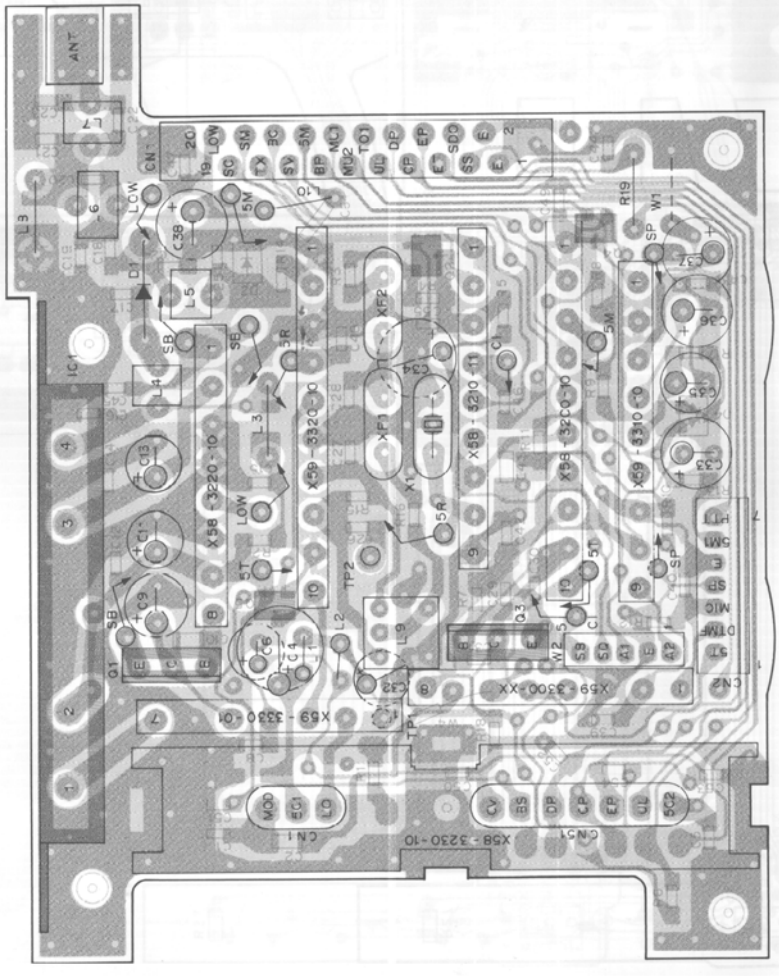
TH-25A/AT/E PC BOARD VIEWS

TX-RX UNIT (X57-3160-XX) Component side view

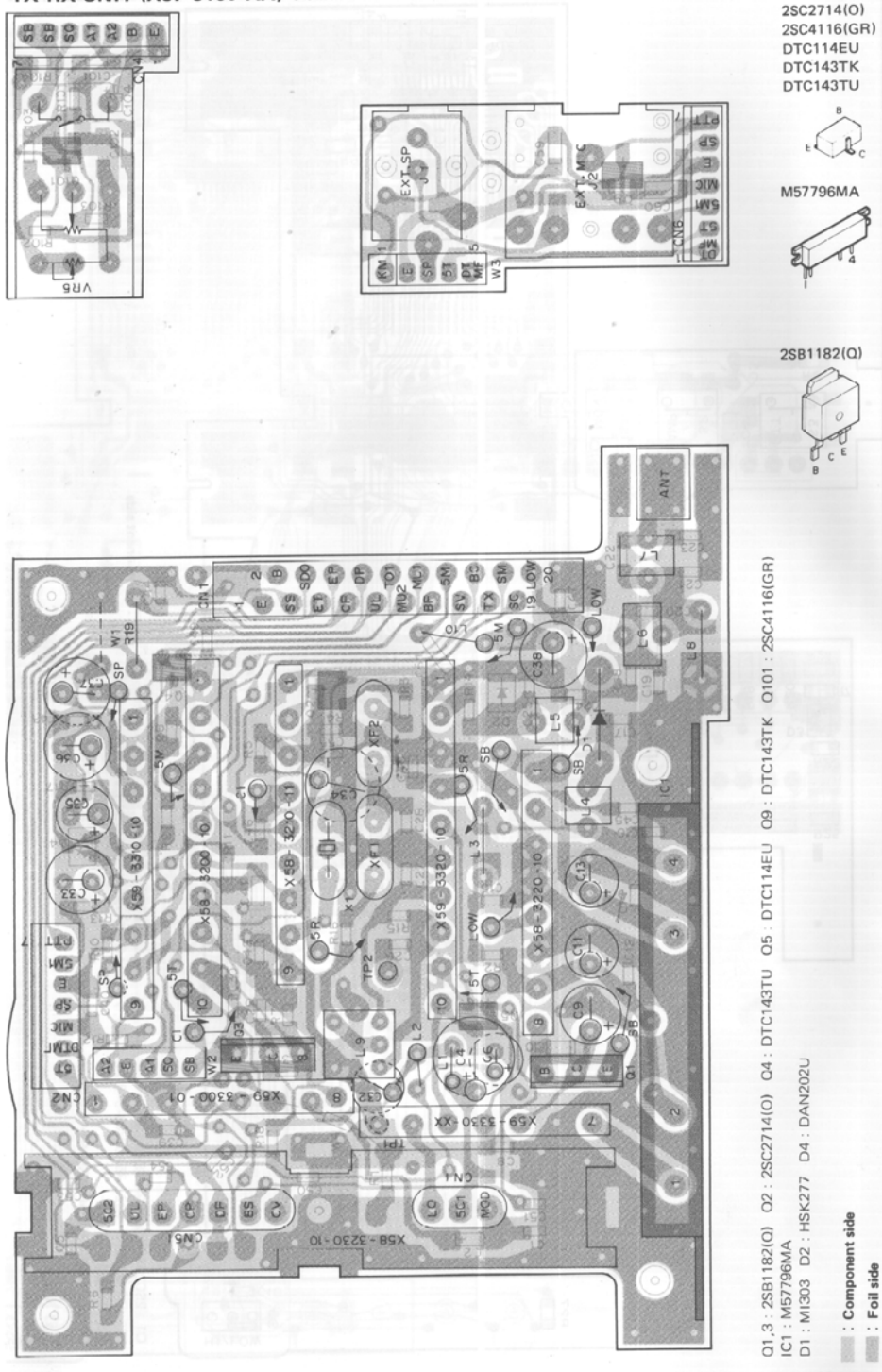
-10 : TH-25AT -21 : TH-25A -61 : TH-25E







TX-RX UNIT (X57-3160-XX) Foil side view



Q1,3 : 2SB1182(Q) Q2 : 2SC2714(O) Q4 : DTC143TU Q5 : DTC114EU Q9 : DTC143TK Q101 : 2SC4116(GR)
IC1 : M57796MA
D1 : MI303 D2 : HSK277 D4 : DAN202U

■ : Component side
■ : Foil side

Signal line — Control line — Common DC line

IC1 LH5008TP D1,D2 1SS184
IC2 μPD75108AG D3,D4 1SS181
IC3 S8054ALR-LN

Q1 2SC2712(Y)
Q2 2SA1162(Y)

IC1 M57796MA
Q1 2SB1182(Q)
Q2 2SC2714(O)
Q3 2SB1182(Q)
Q4 DTC143TU
Q5 DTC114EU
Q9 DTC143TK
D1 MI303
D2 HSK277
D4 DAN202U

CONTROL UNIT (X53-3080-XX)

TX-RX UNIT (X57-3160-XX) (A/3)

MIC AMP (X59-3300-XX)

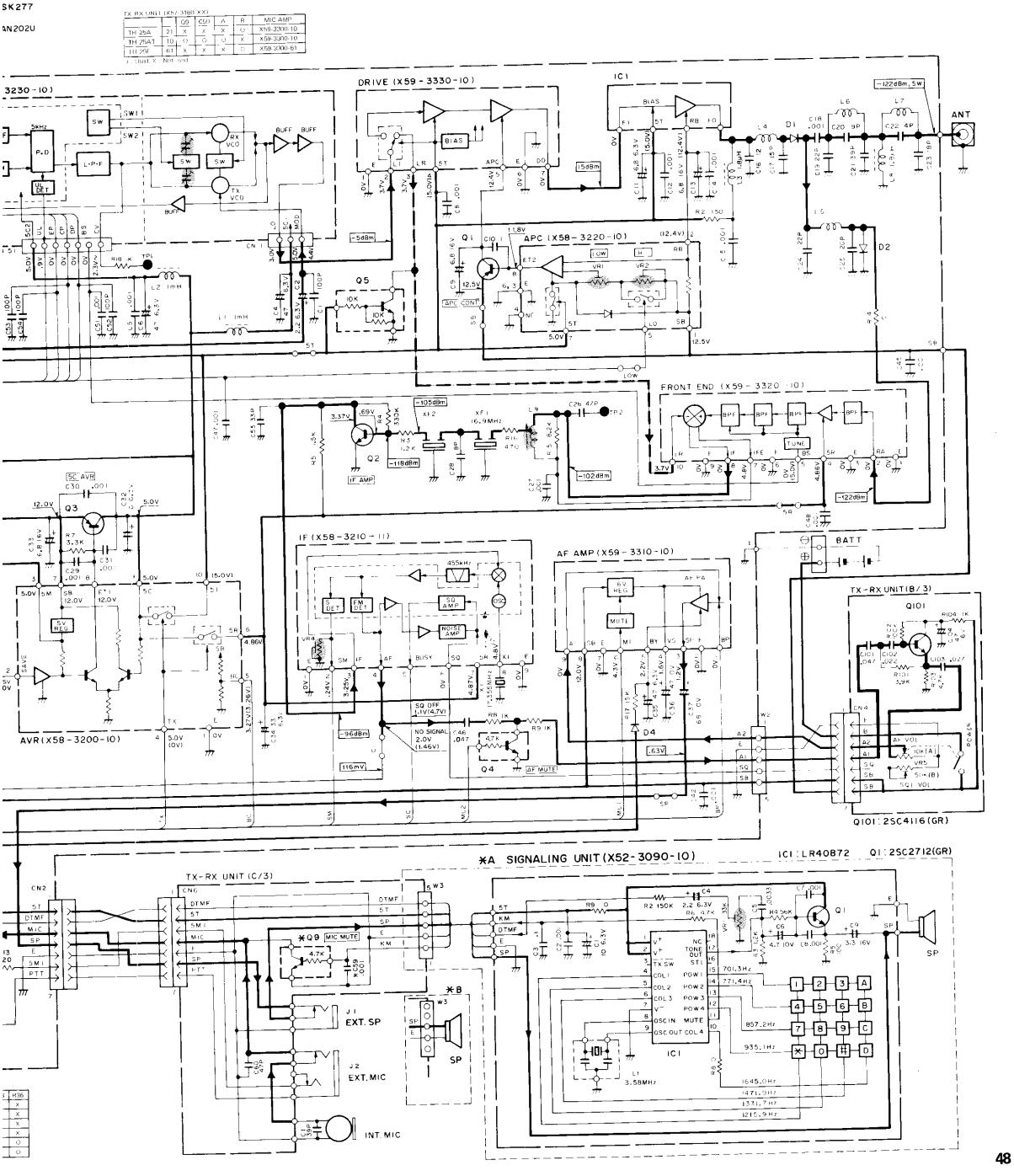
PLL (X58-3230-10)

CTCSS UNIT TSU-6 (OPTION)

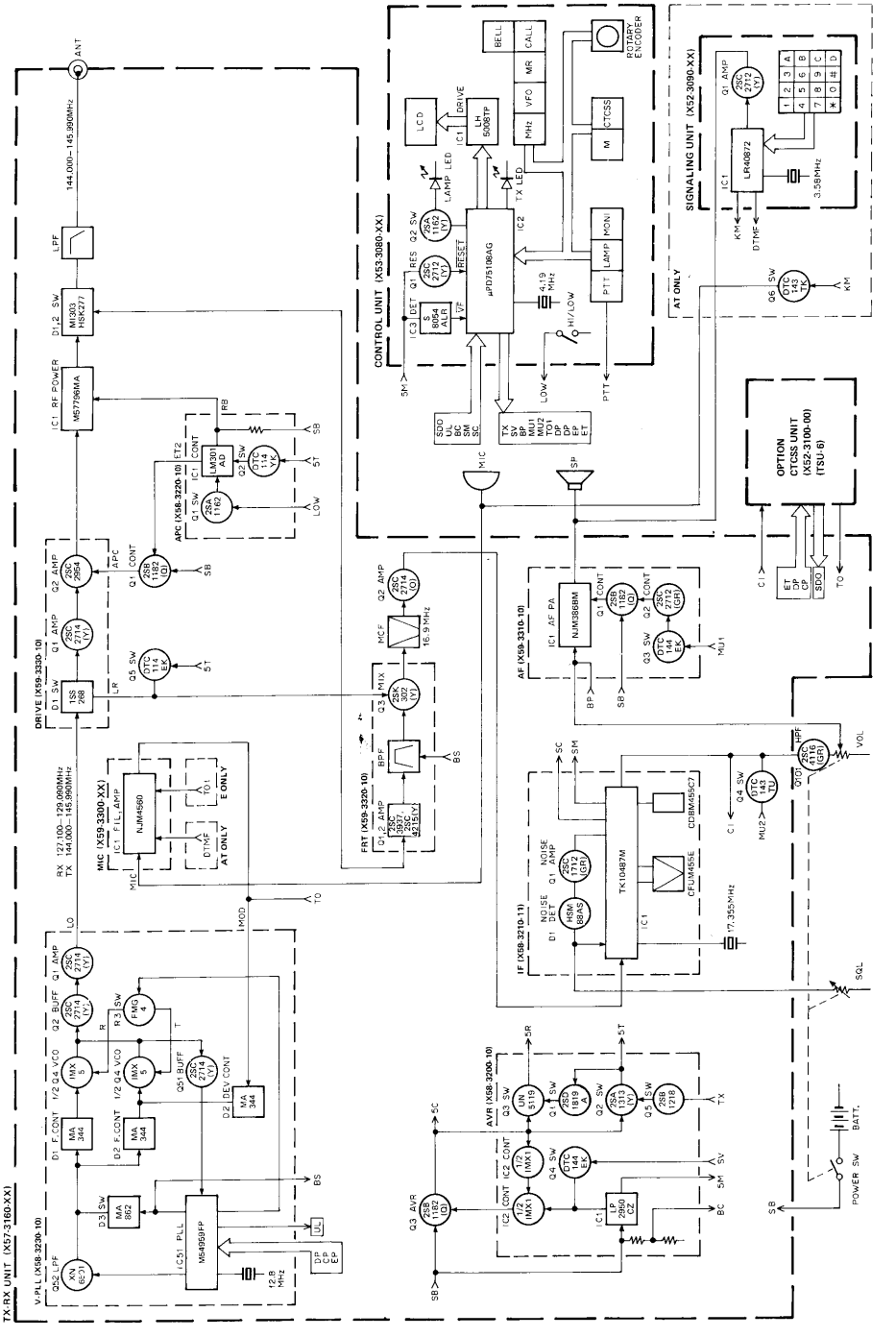
AVR (X58-3200-10)

TX-RX UNIT (X
TH-25A
TH-25AT
TH-25E

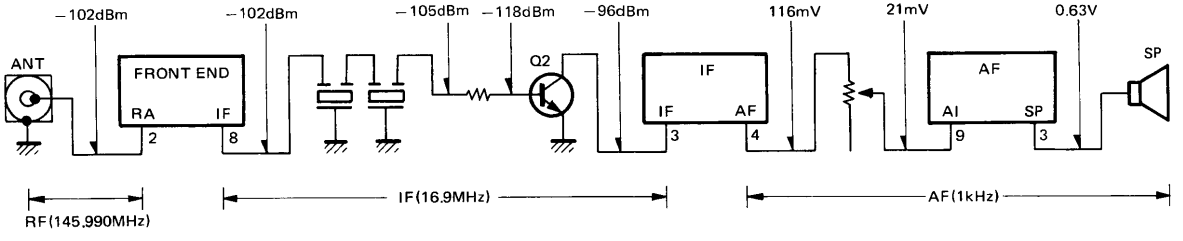
SCHEMATIC DIAGRAM TH-25A/AT/E



BLOCK DIAGRAM

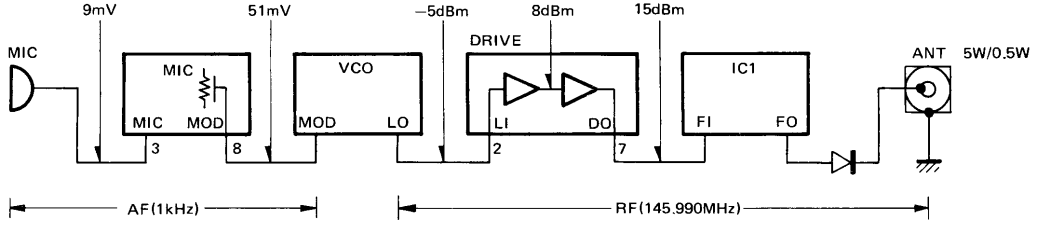


RX SECTION



1. SSG output : 145.990MHz, MOD : 1kHz, DEV : 3.0kHz
2. These SSG signal level values are necessary in order to obtain the 12dB SINAD audio signal.
3. SSG output was measured, using a 0.01μF capacitor.

TX SECTION

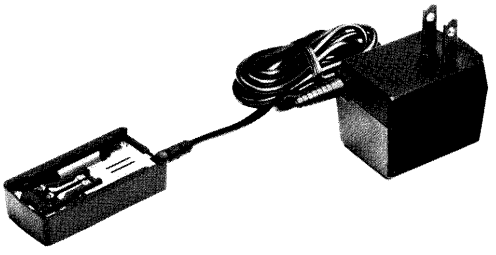


1. ANT is terminated with 50Ω.
2. DC power supply : 12V (Use DC-1).

TERMINAL FUNCTIONS/BC-9 (BATTERY CHARGER)

Connector No.	Terminal No.	Terminal Name	Function
TX-RX UNIT (A/3) — CONTROL UNIT			
CN1	1	E	Ground.
	2	B	Not used.
	3	SS	PTT SW signal. "L" : TX, "H" : RX.
	4	SDO	Tone signal match/mismatch identification signal.
	5	ET	Tone enable.
	6	EP	PLL enable.
	7	CP	Clock signal.
	8	DP	PLL, tone serial data.
	9	UL	PLL unlock signal.
	10	TO1	1750Hz tone signal. **TH-25E**
	11	MU2	Mute signal. "H" : Mute.
	12	MU1	Mute signal. "H" : Mute.
	13	BP	Beep signal.
	14	5M	5V power supply for μ-com and mic.
	15	SV	SAVE signal output. "L" : Save, "H" : Normal.
	16	BC	Battery voltage check signal.
	17	TX	Transmit/receive switching signal. "L" : TX, "H" : RX.
	18	SM	S-meter signal.
	19	SC	Busy signal.
	20	LOW	High/Low power switching signal.
TX-RX UNIT (A/3) — TSU-6			
	1	ET	Tone enable.
	2	DP	Tone serial data.
	3	CP	Clock signal.
	4	TO	Tone output.
	5	PTT	Not used.
	6	SDO	Tone signal match/mismatch identification signal.
	7	CO	Not used.
	8	5C	5V power supply.
	9	CI	Audio signal input.
	10	E	Ground.
TX-RX UNIT (A/3) — TX-RX UNIT (C/3)			
CN2	1	5T	5V power supply for transmit.
	2	DTMF	DTMF signal. **TH-25AT**
	3	MIC	Signal line from microphone.
	4	SP	Signal line to built in speaker.
	5	E	Ground.
	6	5M	5V power supply for μ-com and mic.
	7	PTT	External standby line.
TX-RX UNIT (A/3) — TX-RX UNIT (B/3)			
W2	1	A2	AF volume input line.
	2	E	Ground.
	3	A1	AF amplifier input line.
	4	SQ	Squelch volume input line.
	5	SB	B power supply after power switch.
TX-RX UNIT (C/3)			
W3	1	KM	Mic mute signal. **TH-25AT**
	2	E	Ground.
	3	SP	Audio output.
	4	5T	5V power supply for transmit. **TH-25AT**
	5	DTMF	DTMF signal. **TH-25AT**

BC-9 EXTERNAL VIEW



BC-9 PARTS LIST

* : New Parts

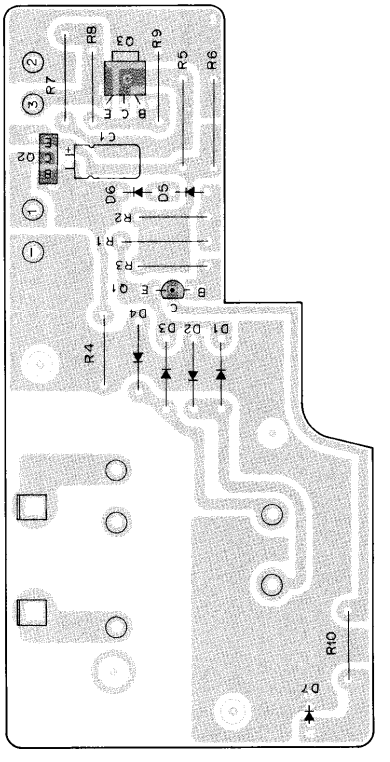
Ref. No.	New Parts	Parts No.	Description
		A02-0814-03	Case (Charge adapter)
		E23-0494-04	Terminal
		E23-0605-04	Terminal
		J19-1426-03	Terminal holder

ANTIQUES2
pagina 1

BC-10 (COMPACT CHARGER)

BC-10 EXTERNAL VIEW

BC-10 PC BOARD VIEW



BC-10 PARTS LIST

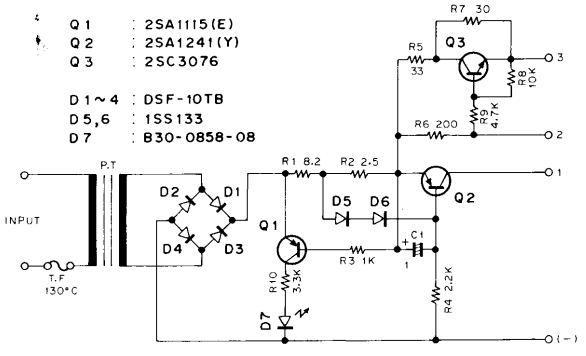
* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	A02-0828-08	Case (Upper) **K,M,M2**
	*	A02-0829-08	Case (Upper) **X,T,W**
	*	A02-0832-08	Case (Lower)
D7	*	B30-0858-08	LED SR615D
	*	B50-8203-08	Instruction manual **K,M,M2,X,W**
	*	B50-8204-08	Instruction manual **T**
	*	E30-2097-08	AC power cord **K,M,M2**
	*	E30-2098-08	AC power cord **X**
	*	E30-2099-08	AC power cord **T**
	*	E30-2100-08	AC power cord **W**
	*	L01-8027-08	Power transformer 220V **M,W**
	*	L01-8111-08	Power transformer 120V **K,M2**
	*	L01-8152-08	Power transformer 240V **X,T**
	*	W02-0805-08	Module
Q1		2SA1115(E)	Transistor
Q2		2SA1241(Y)	Transistor
Q3	*	2SC3076	Transistor
D1–4	*	DSF-10TB	Diode
D5, 6		1SS133	Diode

BC-10 CIRCUIT DIAGRAM

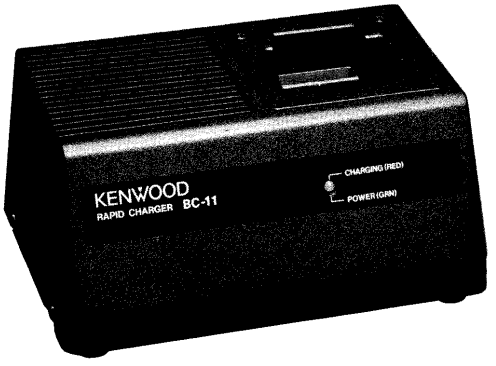
Q1 : 2SA1115(E)
Q2 : 2SA1241(Y)
Q3 : 2SC3076

D1~4 : DSF-10TB
D5,6 : 1SS133
D7 : B30-0858-08



BC-11 (RAPID CHARGER)

BC-11 EXTERNAL VIEW



BC-11 CIRCUIT DESCRIPTION

General

The BC-11 is a rapid charger for the PB-5 to PB-9 Ni-Cd batteries for the TH-25 and TH-45.

Theory of Operation

The operation of each block is explained below.

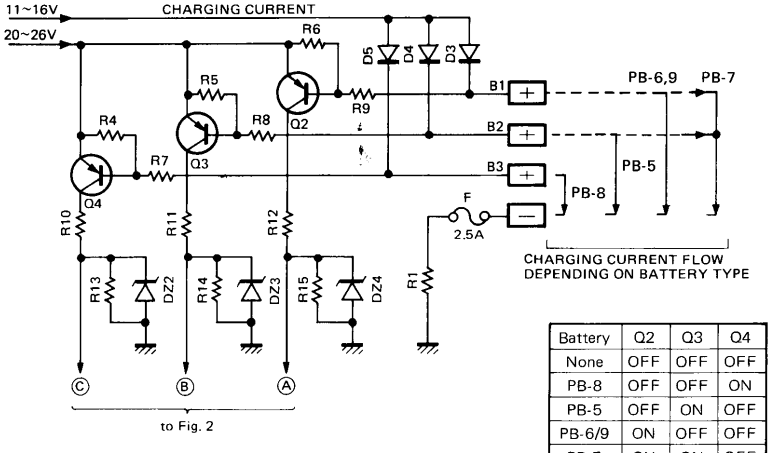
1) + 11V AVR Circuit

This AVR circuit, consisting of a 2SD600F transistor (Q1) and DZA11Y Zener diode (DZ1) provides an output of approximately + 11V as the reference voltage for the charging circuit consisting of IC2 to IC5.

2) Battery Pack Detect Circuit

This circuit detects whether a battery pack is inserted in the charger. Outputs from this circuit are routed to the reset circuit and the battery recognition circuit.

When a PB-6 or PB-9 is inserted in the charger, a small amount of current flows from Q2 : 2SA608E through R9 to the charging terminal B1 and Q2 turns on. As a result, an output of approximately 11V appears at Ⓐ in **Figure 1**. Similarly when a PB-5 or PB-7 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output Ⓑ. When a PB-8 is inserted Q4 : 2SA608E turns on and approximately 11V is provided at output Ⓒ.



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
PB-8	OFF	OFF	ON
PB-5	OFF	ON	OFF
PB-6/9	ON	OFF	OFF
PB-7	ON	ON	OFF

Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

BC-11 (RAPID CHARGER)

3) Reset Circuit/Charge Status Memory Circuit/ Display Circuit

The reset circuit initializes the charging status memory circuit.

	Q8,Q7	Q9	Q10	LED1
PACK OUT	OFF	OFF	ON	–
PACK IN				
• CHARGING	ON	ON	OFF	RED
• COMPLETE	ON	OFF	ON	GRN

Table 2

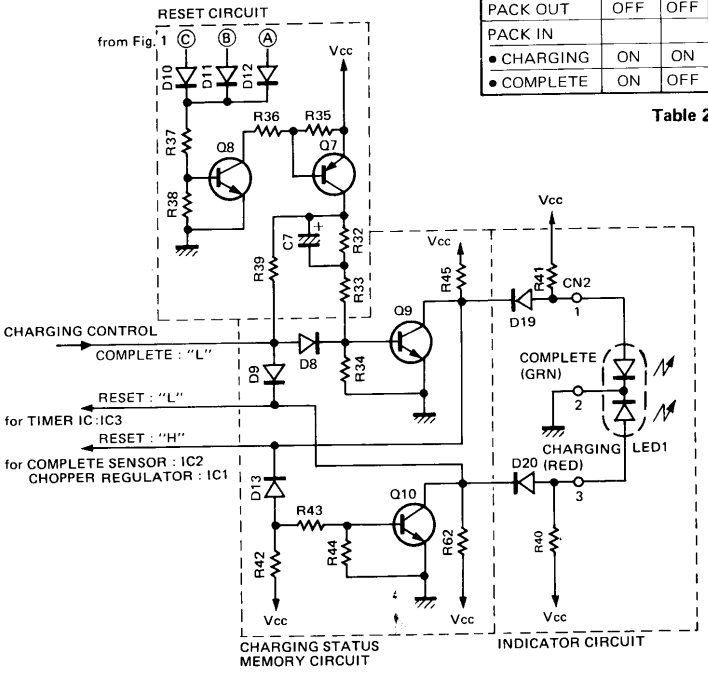


Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

The charge status memory circuit is an R-S flip-flop configured from transistors and resistors. The two states of the flip-flop are called COMPLETE and CHARGING. Outputs from the flip-flop drive the LED in the indicator circuit and reset the timer, complete sensor, and chopper regulator. In the COMPLETE state Q9 : 2SC536E is off and Q10 : 2SC536E is on. In the CHARGING state Q9 is on and Q10 is off.

When a battery pack is not inserted, Q8 : 2SC536E and Q7 : 2SC536E turn off. As there is no base voltage to Q9, Q9 also turns off. The base of Q10 receives enough bias from Vcc to turn on, resulting in 0V at the collector. The current flow through R41 to the COMPLETE indicator in LED1 which glows green, because of Q9 if off.

When the battery pack is inserted Q8 and Q7 turn on. As soon as Q7 turns on, charging current flows through R33, R34, and Q9 to C7 and Q9 turns on. The base voltage of Q10, which is connected to Q9 through diode D13, then drops and Q10 turns off. Since Q10 is off, current flows through R40 to the CHARGING indicator in LED1, which glows red to indicate that the battery is charging. When charging of C7 is completed, on-current continues to flow to the base of Q9 through R39 and D8.

When charging is completed the complete sensor (IC2) outputs a Low ("L")signal that ends the flow of current to the base of Q9, turning Q9 off. As a result current flows through R41 to the COMPLETE indicator in LED1, which glows green to indicate that charging is complete.

BC-11 (RAPID CHARGER)

4) Battery Recognition Circuit

The battery recognition circuit uses NAND logic to recognize the battery type from the outputs from the battery pack detect circuit. Outputs from this circuit are sent to the charging current limiting circuit and sensor level switching circuit.

	INPUT		OUTPUT		
	A	B	D	F	G
PB-5	L	H	H	H	L
PB-6	H	L	H	L	H
PB-7	H	H	L	L	H
PB-8	L	L	H	L	L
PB-9	H	L	H	L	H

Table 3

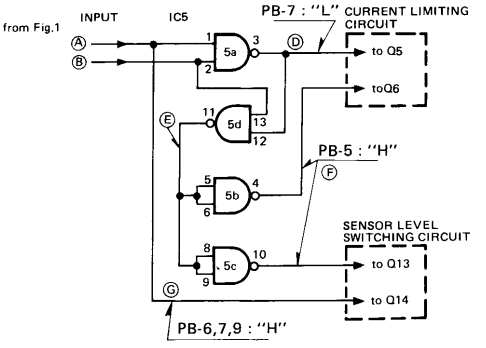


Fig. 3 Battery Recognition Circuit Block Diagram

5) Charging Current Limiting Circuit

This circuit receives the output of the battery recognition circuit and limits the charging current according to the type (current capacity) of battery. The charging current ICR is detected as a voltage drop across R1 (0.15Ω), which is provided to pin 3 of the operational amplifier IC4(1/2) : LA6393A. Pin 4 receives a reference voltage (V_{REF}) used as a comparison standard for limiting the charging current. The V_{REF} is changed by ON and OFF of Q5 and Q6 (See **Table 4**).

Pin 2 of IC4 : LA6393S provides "L" output when $V_{REF} < V_{CR}$, stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula :

I_{CR} MAX (A) = V_{REF} (V)/0.15(Ω)

	Q5	Q6	VREF	ICR MAX
PB-5	OFF	ON	0.15V	1.0A
PB-6	OFF	OFF	0.25V	1.7A
PB-7	ON	OFF	0.36V	2.4A
PB-8	OFF	OFF	0.25V	1.7A
PB-9	OFF	OFF	0.25V	1.7A

Table 4

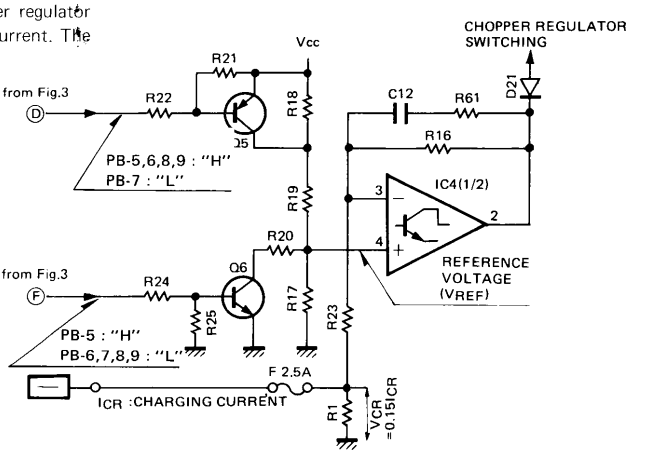


Fig. 4 Charging Current Limiting Circuit Block Diagram

BC-11 (RAPID CHARGER)

6) Sensor Level Switching Circuit

This circuit receives the output of the battery recognition circuit and aligns the voltages supplied to the charging status detect circuit according to the battery type (voltage) so that they are nearly equal at completion of charging.

	SHIFT Es(V)	Q11	Q12
PB-5	2.0	ON	OFF
PB-6	2.0	OFF	ON
PB-7	2.0	OFF	ON
PB-8	7.6	OFF	OFF
PB-9	2.0	OFF	ON

Table 5

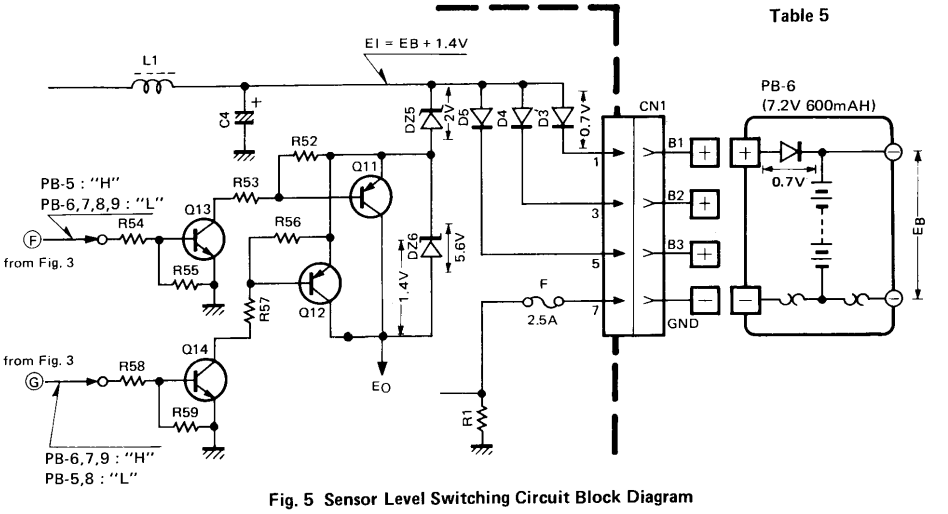


Fig. 5 Sensor Level Switching Circuit Block Diagram

The pin voltages while the Ni-Cd battery is charging are approximately 1.2 times the voltages at the completion of charging. (See **Figure 6**.)

The battery terminal voltage EB is as follows:

Approximately 14.4V for the PB-8

Approximately 8.6V for the PB-5, 6, 7, 9

The charging line voltage EI is the EB voltage plus a 1.4V voltage drop added by a diode.

EI = EB + 1.4V . . . . . (1)

Fig. 6 The pin voltages while the Ni-CD Battery is charging

The EI voltage is output with a level shift as the voltage EO to the charging status detect circuit via Zener diode DZ6 and diodes D17 and D18. The amount of the shift is controlled by switching Q11 : 2SA608E and Q12 : 2SA608E on and off. (See **Table 5**.) If Eq. (1) is substituted into EO in **Table 5**, the results are:

PB-8 : EO = EB – 6.2V

PB-5, 6, 7, 9 : EO = EB – 0.6V

At the completion of charging the value is approximately 8V.

BC-11 (RAPID CHARGER)

7) Charging Status Detect Circuit

This circuit detects the completion of charging and outputs a signal to stop charging. When no battery pack is inserted or charging is completed, a High ("H") Reset signal is applied to D15. When a battery is inserted the Reset signal applied to D15 is cleared. When the Reset signal is cleared, pin 4 of IC2 : KCH-1003 holds the reset state due to the charge in C8 for the duration of the R46-C8 time constant, then goes "L" to clear the reset state. Pins 8 and 9 of IC2 receive divided portions of the battery voltage.
These inputs are tracked as the charging is performed in the long-term memory capacitor "MD". As the Ni-Cd battery charges, the battery voltage reaches a peak, then declines. (See **Figure 6**.) The MD stores the peak voltage, which is compared with the divided voltages at pins 8 and 9. When the difference ΔV is the same, a "L" signal is output from pin 11 to indicate that charging is complete. The signal indicating completion of charging is applied to the charging status memory circuit.

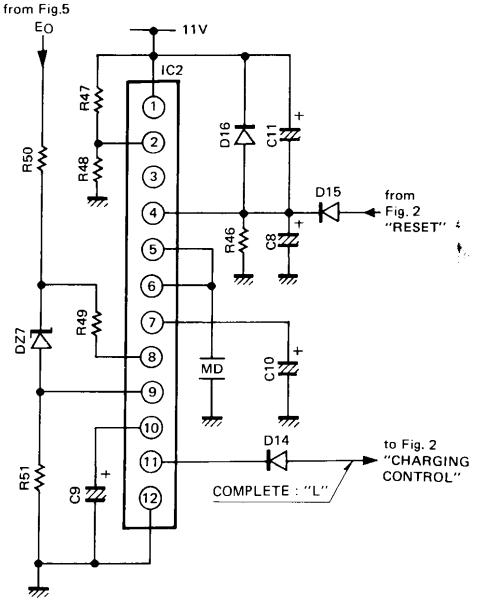


Fig. 7 Charging Status Detect Circuit Block Diagram

8) Timer Circuit

Battery defects may result in charging continuing indefinitely without completion, so this timer outputs a signal that stops charging approximately 1.7 hours after charging begins. When charging begins and the Reset signal is cleared at pin 3, IC3 : AN6780 begins counting. At the first count of 16384 pin 6 goes from "H" to "L".
The output from pin 6 is connected to the Stop input (pin 2), so the output of IC3 is held in the "L" state until IC3 receives another Reset signal (for example, when the battery is removed).

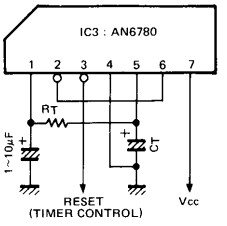


Fig. 8 Timer Circuit Block Diagram

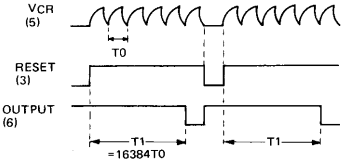


Fig. 9 TIMER TIME T1(s)≅11RT(KΩ)·CT(μF)
TIMER TIME T1(s)≅11×47(KΩ)·10(μF)=5170 (s)

9) Voltage Comparator Circuit

This circuit monitors the output (EO) of the sensor level switching circuit and indirectly detects abnormal conditions in the battery pack connected to the charging terminal. When the EO voltage falls to 5.2V or lower, the charging control line goes "L" to halt charging.

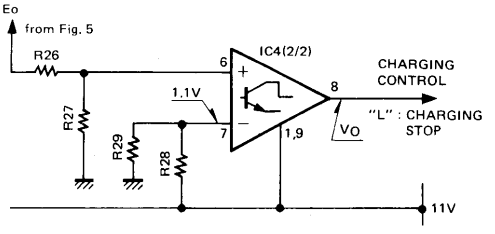


Fig. 10 Voltage Comparator Circuit Block Diagram

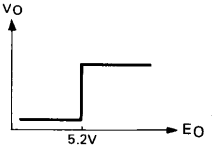


Fig. 11

BC-11 (RAPID CHARGER)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Teile ohne **Parts No.** werden nicht geliefert.

BC-11 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			BC-11			
1	1A	*	A02-0815-08	CASE		
2	1A,1B	*	A02-0817-08	BATTERY POCKET		
3	1B		B46-0411-00	WARRANTY CARD	K	
4	1B	*	B50-8134-08	INSTRUCTION MANUAL		
5	1B	*	E23-0604-05	TERMINAL		
⚠ 6	2A		E30-2038-08	AC CORD	K,M,M2	
⚠ 6	2A		E30-2072-08	AC CORD	W	
⚠ 6	2A		E30-2073-08	AC CORD	T	
⚠ 6	2A		E30-2095-08	AC CORD	X	
8	2B	*	H01-8128-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A		J39-0424-05	SPACER		
⚠ T1	2A		L01-8081-08	POWER TRANSFORMER (AC120V)	K,M2	
⚠ T1	2A		L01-8112-08	POWER TRANSFORMER (AC220V)	M,W	
⚠ T1	2A		L01-8122-08	POWER TRANSFORMER (AC240V)	T,X	
A	3A		N30-3006-41	MACHINE SCREW (M3 X 6)		
B	2A,1B		N34-4006-46	MACHINE SCREW (M4 X 6 TR)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 BI) BLK		
D	2A		N87-3008-46	TAPTITE SCREW (φ3 X 8 BR)		
E	1A		N89-3008-45	TAPTITE SCREW (φ3 X 8 BI) BLK		
SW1	3A		S36-1407-05	POWER SW		
7	3B	*	W02-0399-08	CHARGE CONTROL UNIT		
			CHARGE CONTROL UNIT (W02-0399-08)			
C1			CE04EW1V222M	ELECTRO 2200μF 35WV		
C2			CE04EW1C470M	ELECTRO 47μF 16WV		
C3			CE04EW1H010M	ELECTRO 1μF 50WV		
C4			CE04EW1E471M	ELECTRO 470μF 25WV		
C5,6			CE04EW1C100M	ELECTRO 10μF 16WV		
C7			CE04EW1A101M	ELECTRO 100μF 10WV		
C8			CE04EW1C100M	ELECTRO 10μF 16WV		
C9,10			CE04EW0J101M	ELECTRO 100μF 6.3WV		
C11			CE04EW1C330M	ELECTRO 33μF 16WV		
C12			CK45B1H102K	CERAMIC 0.001μF 50WV		
C14			CE04EW1H010M	ELECTRO 1μF 50WV		

E: Scandinavia & Europe **H**:Audio Club **K**: USA **P**: Canada **W**:Europe
A: Saudi Arabia **T**: England **U**: PX(Far East, Hawaii)
UE: AAFES(Europe) **X**: Australia **M**: Other Areas

⚠ indicates safety critical components.

BC-11 (RAPID CHARGER)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

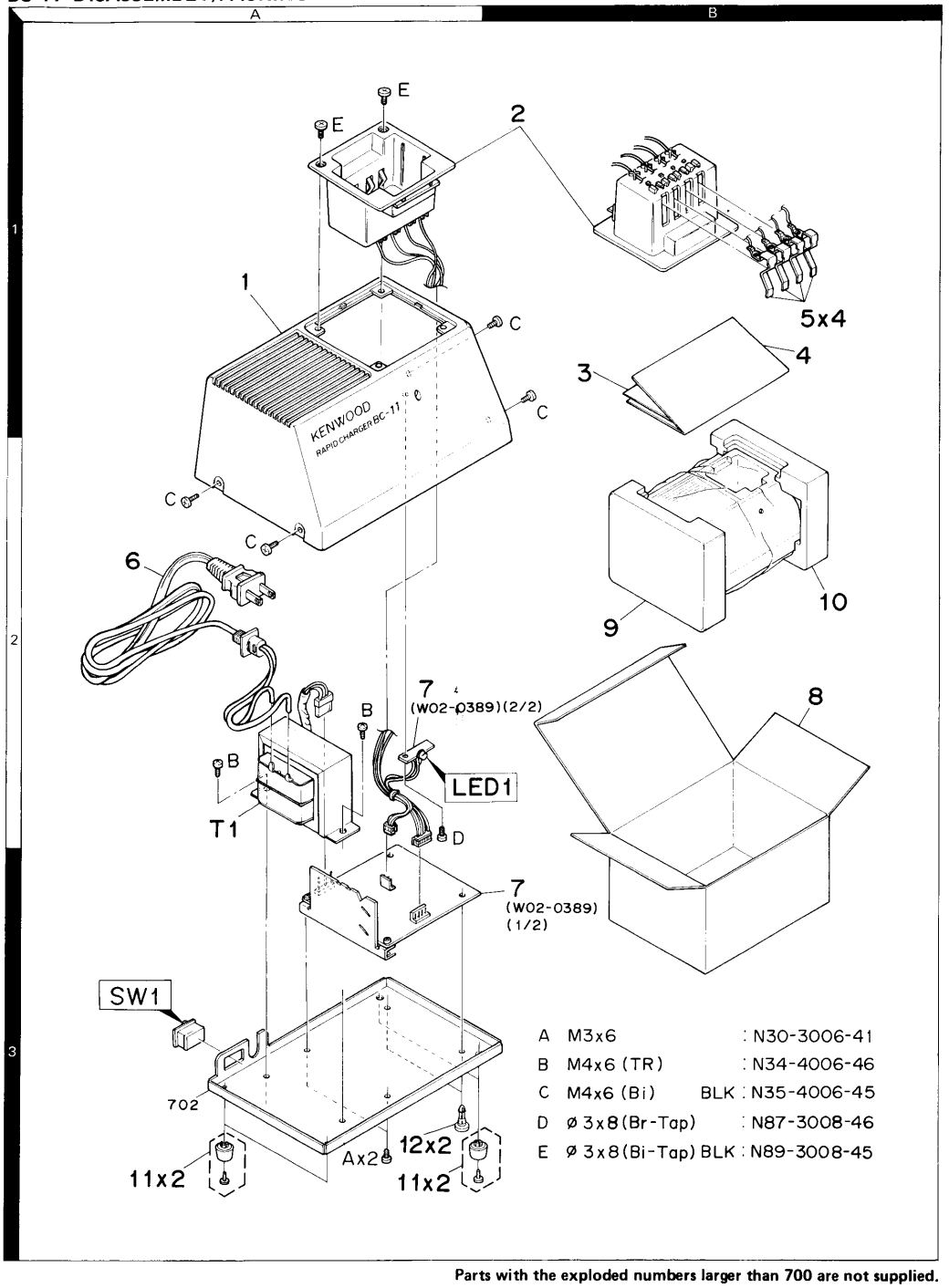
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
MD			C91-1038-08	ELECTRO		
⚠ F1			F05-2525-05	FUSE (2.5A)	W,X	
⚠ F1			F06-2522-05	FUSE (2.5A)	M,M2,T	
⚠ F1			F06-2523-05	FUSE (2.5A)	K	
—			J13-0039-05	FUSE HOLDER	W	
L1			L33-0694-08	CHOKE COIL (470μH)		
R1			R92-0683-08	FL-PROOF 0.15Ω 4W		
D1–5			DSA26B	DIODE		
D6–16			DS442	DIODE		
D19–21			DS442	DIODE		
DZ1			GZA11Y	ZENER DIODE (11V)		
DZ2–4			GZA10Z	ZENER DIODE (10V)		
DZ5			GZA2.0X	ZENER DIODE (2V)		
DZ6			GZA5.6X	ZENER DIODE (5.6V)		
DZ7			GZA7.5Y	ZENER DIODE (7.5V)		
DZ8			GZA3.0X	ZENER DIODE (3V)		
IC1			STK772B	IC (CHOPPER REGULATOR)		
IC2			KCH-1003	IC (VOLTAGE SENSOR)		
IC3			AN6780	IC (TIMER)		
IC4			LA6393S	IC (DUAL OP IC)		
IC5			LC4011B	IC (QUADRUPLE NAND GATE)		
Q1			2SD600F,KF	TRANSISTOR		
Q2–5			2SA608E,F	TRANSISTOR		
Q6			2SC536E,F	TRANSISTOR		
Q7			2SA608E,F	TRANSISTOR		
Q8–10			2SC536E,F	TRANSISTOR		
Q11,12			2SA608E,F	TRANSISTOR		
Q13,14			2SC536E,F	TRANSISTOR		
LED1	2A		SLP-540D	LED (RED/GRN)		

E: Scandinavia & Europe **H**:Audio Club **K**: USA **P**: Canada **W**:Europe
A: Saudi Arabia **T**: England **U**: PX(Far East, Hawaii)
UE: AAFES(Europe) **X**: Australia **M**: Other Areas

⚠ indicates safety critical components.

BC-11 (RAPID CHARGER)

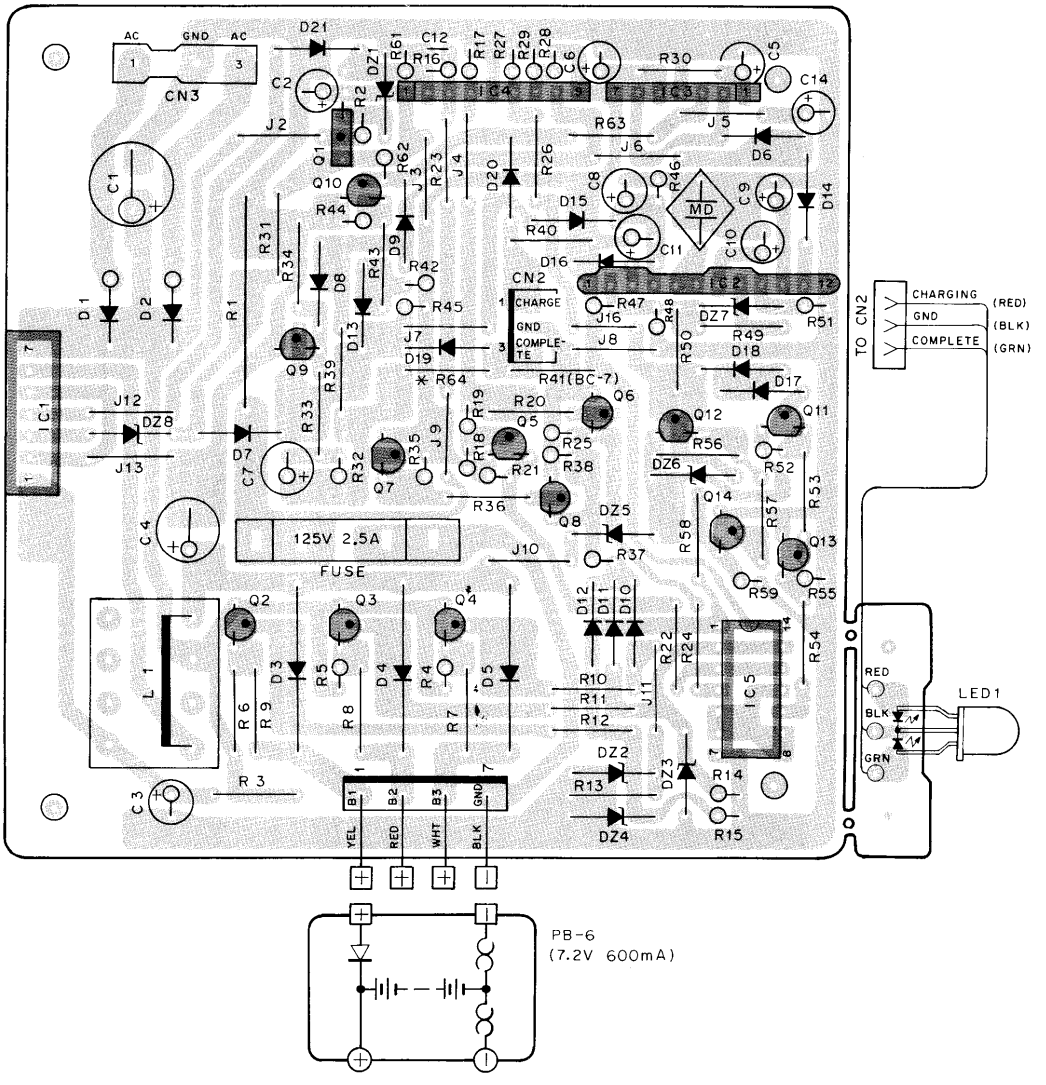
BC-11 DISASSEMBLY/PACKING



Parts with the exploded numbers larger than 700 are not supplied.

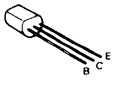
BC-11 (RAPID CHARGER)

BC-11 PC BOARD VIEW

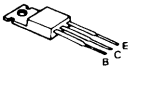


Q1 : 2SD600F,KF Q2–5,7,11,12 : 2SA608E,F Q6,8–10,13,14 : 2SC536E,F
IC1 : STK772B IC2 : KCH-1003 IC3 : AN6780 IC4 : LA6393S IC5 : LC4011B
D1–5 : DSA26B D6–16,19–21 : DS442
DZ1 : GZA11Y DZ2–4 : GZA10Z DZ5 : GZA2.0X DZ6 : GZA5.6X DZ7 : GZA7.5Y DZ8 : GZA3.0X

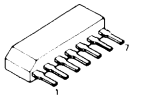
2SA608E
2SA608F



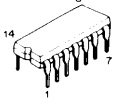
2SC536E 2SD600F
2SC536F 2SD600KF



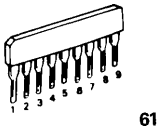
AN6780



LC4011B

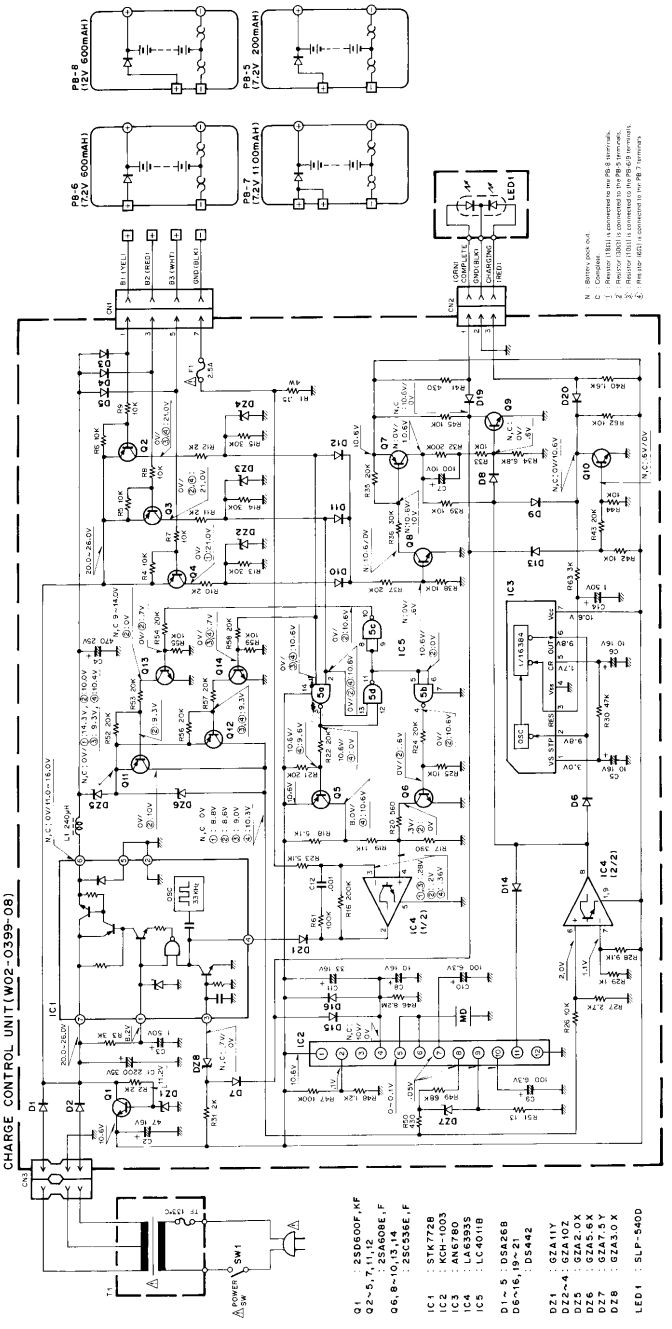


LA6393S



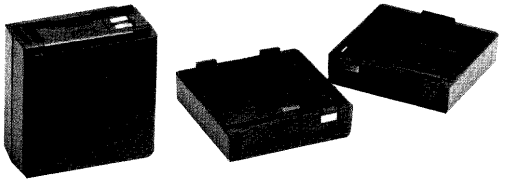
BC-11 (RAPID CHARGER)

BC-11 CIRCUIT DIAGRAM



BT-6 (AAA MANGANESE/ALKALINE BATTERY CASE)/ DC-1 (DC ADAPTER)

BT-6 EXTERNAL VIEW

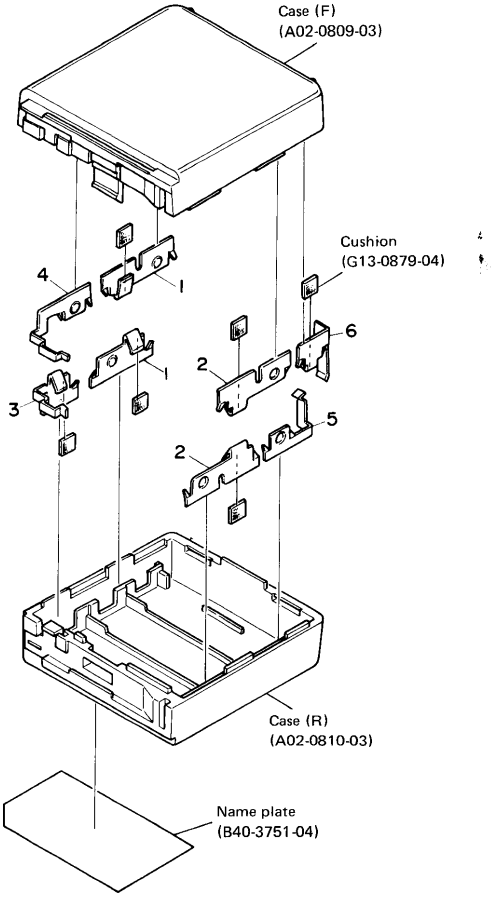


BT-6 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
1	*	E23-0496-04	Terminal A
2	*	E23-0497-04	Terminal B
3	*	E23-0498-04	Terminal C
4	*	E23-0499-04	Terminal D
5	*	E23-0500-04	Terminal E
6	*	E23-0601-04	Terminal F

BT-6 DISASSEMBLY



DC-1 EXTERNAL VIEW

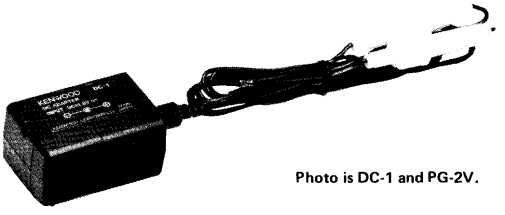


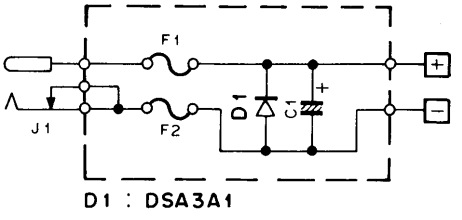
Photo is DC-1 and PG-2V.

DC-1 PARTS LIST

* : New Parts

Ref No.	New Parts	Parts No.	Description
C1		CW04EW1C102M	Electro 1000μF 16WV
J1		E03-0165-05	DC jack
		F06-3026-05	Fuse (3A)
	*	J13-0410-05	Fuse holder
D1		DSA3A1	Diode

DC-1 CIRCUIT DIAGRAM



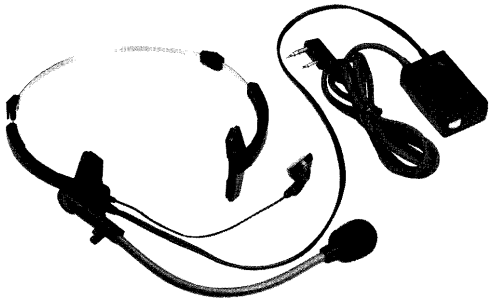
DC-1 SPECIFICATIONS

Electrical characteristic

Max. input voltage 16V
Max. current 2A
Dimensions . . . . . 58 W x 36.5 H x 29.5 D (mm)
Weight 40g

HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 EXTERNAL VIEW



HMC-2 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	A02-0840-08	Case (Front)
	*	A02-0841-08	Case (Rear)
	*	E30-2088-08	Cable with plug
	*	F09-0418-08	Microphone pad
	*	F09-0419-08	Ear pad
	*	J29-0427-08	Clip
VR1	*	R05-4422-08	Potentiometer 50kΩ
S1	*	S31-1416-08	Slide switch PTT/VOX
S2		S50-1413-05	Tact switch PTT
	*	T18-0056-08	Earphone with cable
	*	T91-0373-08	Microphone
	*	W02-0806-08	VOX/PTT unit
Q1		FMG2	Digital transistor
Q2	*	FMW2	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1	*	NJM2072M	IC
D1		1SS133	Diode

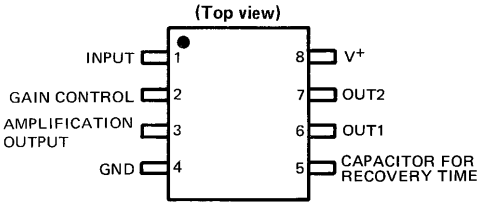
HMC-2 SPECIFICATIONS

Electrical characteristic

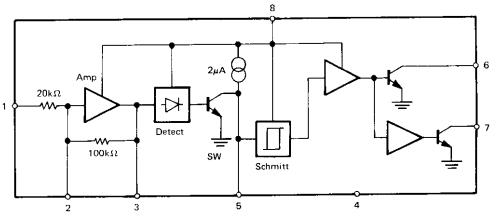
- **Earphone**
  - Diameter φ19
  - Impedance 19Ω (1000Hz)
  - Max. input power 50mW
- **Microphone**
  - Output sensitivity . . . −70dB (0dB = 1V/μbar 1000Hz)
  - Output impedance 1.6kΩ (1000Hz)

HMC-2 SEMICONDUCTOR DATA

- **Terminal connection diagram**



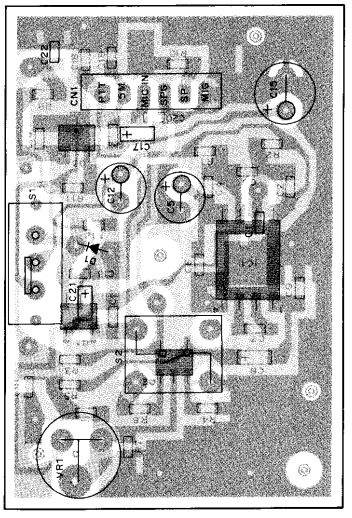
- **Block diagram**



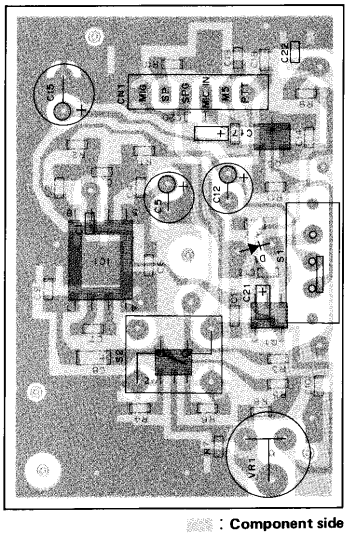
HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 PC BOARD VIEWS

Component side view

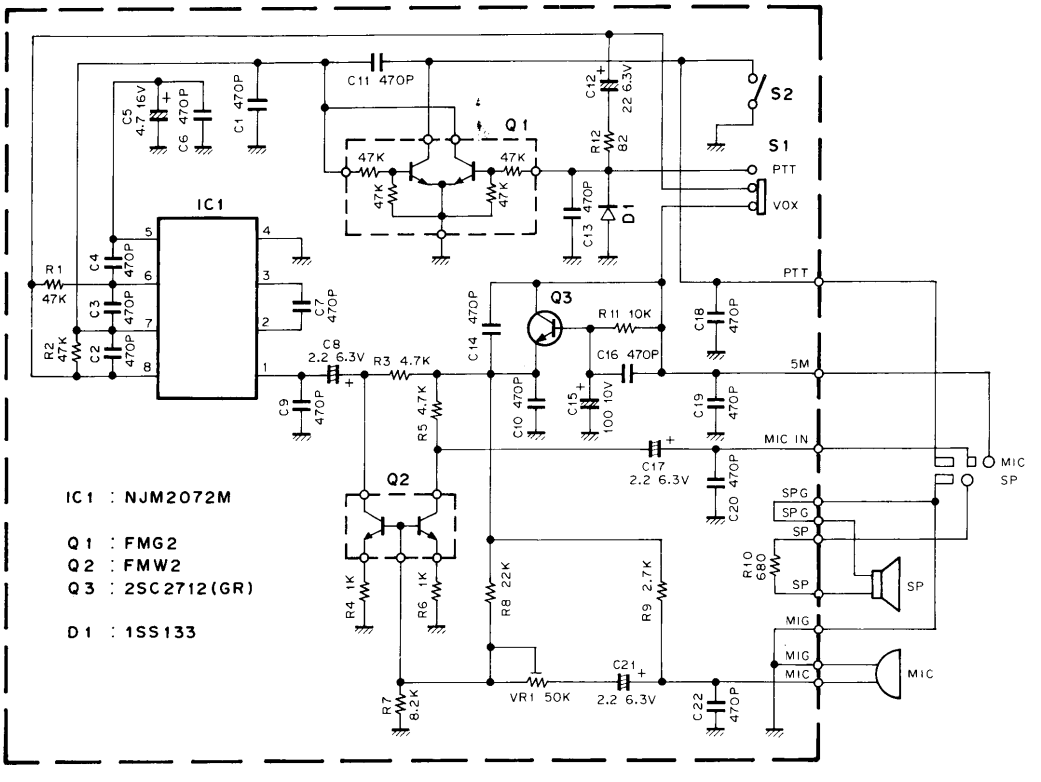


Foil side view



: Component side
: Foil side

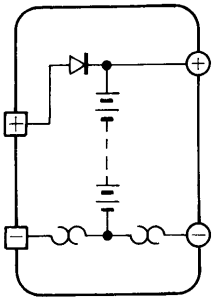
HMC-2 CIRCUIT DIAGRAM



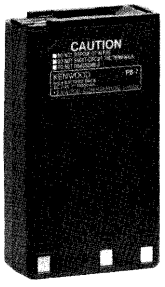
PB-5/6/7/8/9 (Ni-Cd BATTERY)

PB-5 EXTERNAL VIEW

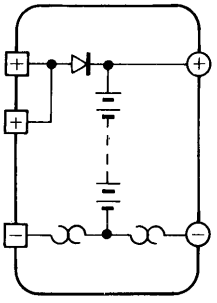
PB-5 CIRCUIT DIAGRAM



PB-7 EXTERNAL VIEW



PB-7 CIRCUIT DIAGRAM



PB-5 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	200mAh
Dimensions	58 W x 36.5 (39.5) H x 29.5 D (mm)
Weight	80g

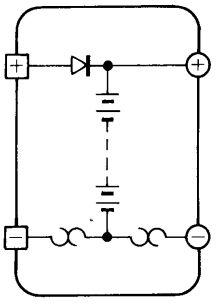
PB-7 SPECIFICATIONS

Electrical characteristic

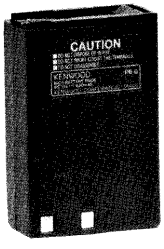
Voltage	7.2V (1.2V x 6)
Charging current	1100mAh
Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	300g

PB-6 EXTERNAL VIEW

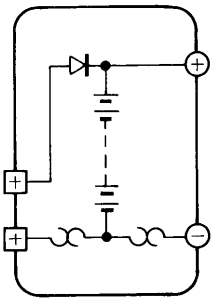
PB-6 CIRCUIT DIAGRAM



PB-8 EXTERNAL VIEW



PB-8 CIRCUIT DIAGRAM



PB-6 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Dimensions	58 H x 55.5 (58.5) H x 29.5 D (mm)
Weight	180g

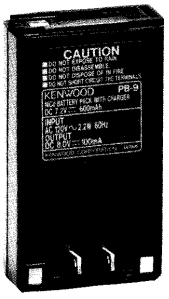
PB-8 SPECIFICATIONS

Electrical characteristic

Voltage	12V (1.2V x 10)
Charging current	600mAh
Dimensions	58 W x 84 (87) H x 29.5 D (mm)
Weight	270g

PB-5/6/7/8/9 (Ni-Cd BATTERY)

PB-9 EXTERNAL VIEW

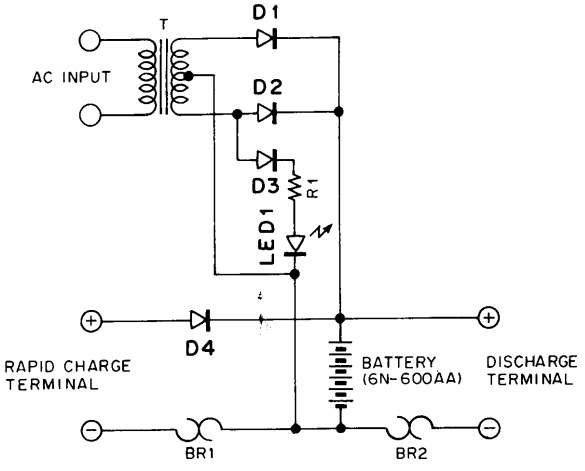


PB-9 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Charging input	AC 100 to 120V, 50/60Hz, 2.2W
Charging output	DC 8.0V, 100mA
Charging time	Approx. 10 hours
Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	260g

PB-9 SCHEMATIC DIAGRAM



PB-5/6/7/8/9 CHARGING TIME

Battery / Charger	PB-5	PB-6	PB-7	PB-8	PB-9
BC-9		15	30		
BC-10	8	8	15	8	8
BC-11	1	1	1	1	1

Unit : Hour

TH-25A/AT/E

SC-14/15/16 (SOFT CASE)/SMC-31 (SPEAKER MICROPHONE)

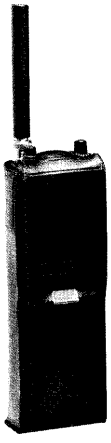
SC-14 EXTERNAL VIEW

with PB-5.

SC-15 EXTERNAL VIEW

with PB-6.

SC-16 EXTERNAL VIEW



with PB-7, 8 or 9.

SMC-31 EXTERNAL VIEW

SMC-31 SPECIFICATIONS

Electrical characteristic

- **Speaker**
  - Diameter . . . . . ϕ45 (mm)
  - Impedance 8Ω
  - Rated input power 0.15W
  - Max. input power 0.3W
- **Microphone**
  - Sensitivity . . . . . 66dB ± 3dB at 1300Hz
  - Output impedance . . . . . 2kΩ ± 30% at 1000Hz

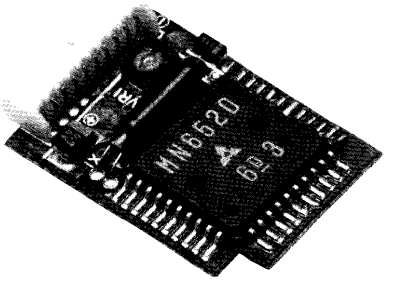
SMC-31 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	D10-0605-08	PTT lever
	*	E30-2110-05	Curl cord ass'y
		J19-1360-08	Clip
		T07-0219-08	Speaker
		T97-1024-08	Microphone

TSU-6 (CTCSS UNIT)

TSU-6 EXTERNAL VIEW



TSU-6 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		CTCSS UNIT (X52-3100-00)	
C1		CK73FB1H102K	Chip C 1000pF K
C2		C92-0010-05	Tantal 6.8μF 6.3WV
C3	*	C92-0006-05	Tantal 3.3μF 4.0WV
C4, 5		CK73EB1E104K	Chip C 0.1μF K
C6		CK73EB1H223K	Chip C 0.022μF K
C7		CK73EB1E104K	Chip C 0.1μF K
C8, 9		CC73FCH1H150J	Chip C 15pF J
C10		CK73FB1H102K	Chip C 1000pF K
C11		CK73EB1E104K	Chip C 0.1μF K
C12		C92-0507-05	Chip tan. 4.7μF 6.3WV
C13	*	C92-0510-05	Chip tan. 3.3μF 4.0WV
	*	E40-5121-05	Pin connector (10P)
X1		L77-1313-05	X'tal resonator 4.194304MHz
R1–10		RK73FB2A○○○J	Chip resistor
R12–14		RK73FB2A○○○J	Chip resistor
VR1	*	R12-3460-05	Trimming pot. 33kΩ
Q1		DTC144TK	Digital transistor
Q2		DTA114EK	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1		MN6520	IC
IC2		MN4094BS	IC

TSU-6 FINE ADJUSTMENT OF TONE FREQUENCY

The tone frequency can be fine adjusted with an interval of 0.5% step over the range of 0 to +1.5%. Ground the T1 (pin 10) and T2 (pin 9) of IC1 to obtain the desired frequency.

	T1	T2
0%	X	X
+0.5%	O	X
+1.0%	X	O
+1.5%	O	O

O : GND, X : OPEN

Table 3

TSU-6 REFERENCE DATA

TH-25's condition and MN4094BS (IC2) relationship

CTCSS switch	TONE switch	TX/RX	MN4094BS terminal		
			Q5	Q6	Q1 ~ 4, 7, 8
OFF	OFF	TX	L	H	L
		RX	L	H	L
	ON	TX	L	L	See table 2
		RX	L	H	L
ON	OFF	TX	L	L	See table 2
		RX	H	L	
	ON	TX	L	L	
		RX	H	L	

Q1 ~ 4, 7, 8 : Tone frequency setting
Q5 : TX/RX switch for MN6520 (IC1). "H" : RX, "L" : TX.
Q6 : Power switch for MN6520 (IC1). "H" : OFF, "L" : ON.

Table 1

Tone frequency and MN6520 (IC1) relationship

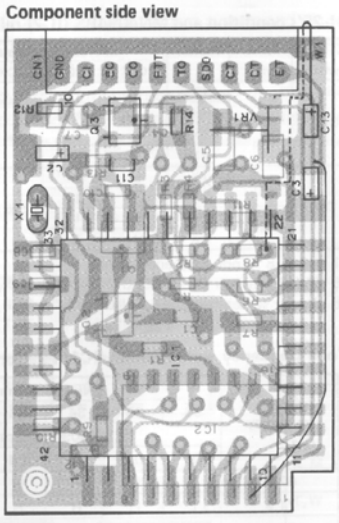
Tone frequency (Hz)	MN6520 terminal					
	$\overline{S6}$	$\overline{S5}$	$\overline{S4}$	$\overline{S3}$	$\overline{S2}$	$\overline{S1}$
	MN4094BS terminal					
	Q1	Q2	Q3	Q4	Q7	Q8
67.0	L	H	H	H	L	H
71.9	L	H	H	H	L	L
74.4	L	H	H	L	H	H
77.0	L	H	H	L	H	L
79.7	L	H	H	L	L	H
82.5	L	H	H	L	L	L
85.4	L	H	L	H	H	H
88.5	L	H	L	H	H	L
91.5	L	H	L	H	L	H
94.8	H	H	H	L	L	H
100.0	H	H	H	L	L	L
103.5	H	H	L	H	H	H
107.2	H	H	L	H	H	L
110.9	H	H	L	H	L	H
114.8	H	H	L	H	L	L
118.8	H	H	L	L	H	H
123.0	H	H	L	L	H	L
127.3	H	H	L	L	L	H
131.8	H	H	L	L	L	L
136.5	H	L	H	H	H	H
141.3	H	L	H	H	H	L
146.2	H	L	H	H	L	H
151.4	H	L	H	H	L	L
156.7	H	L	H	L	H	H
162.2	H	L	H	L	H	L
167.9	H	L	H	L	L	H
173.8	H	L	H	L	L	L
179.9	H	L	L	H	H	H
186.2	H	L	L	H	H	L
192.8	H	L	L	H	L	H
203.5	H	L	L	H	L	L
210.7	H	L	L	L	H	H
218.1	H	L	L	L	H	L
225.7	H	L	L	L	L	H
233.6	H	L	L	L	L	L
241.8	L	H	H	H	H	H
250.3	L	H	H	H	H	L

Table 2

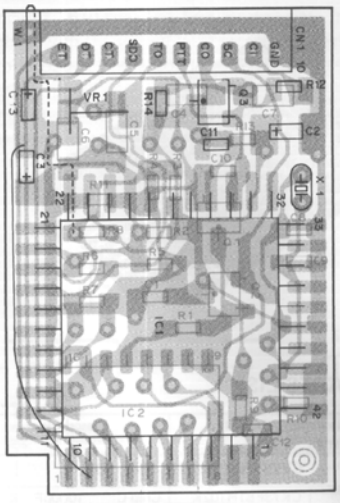
TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS

Component side view



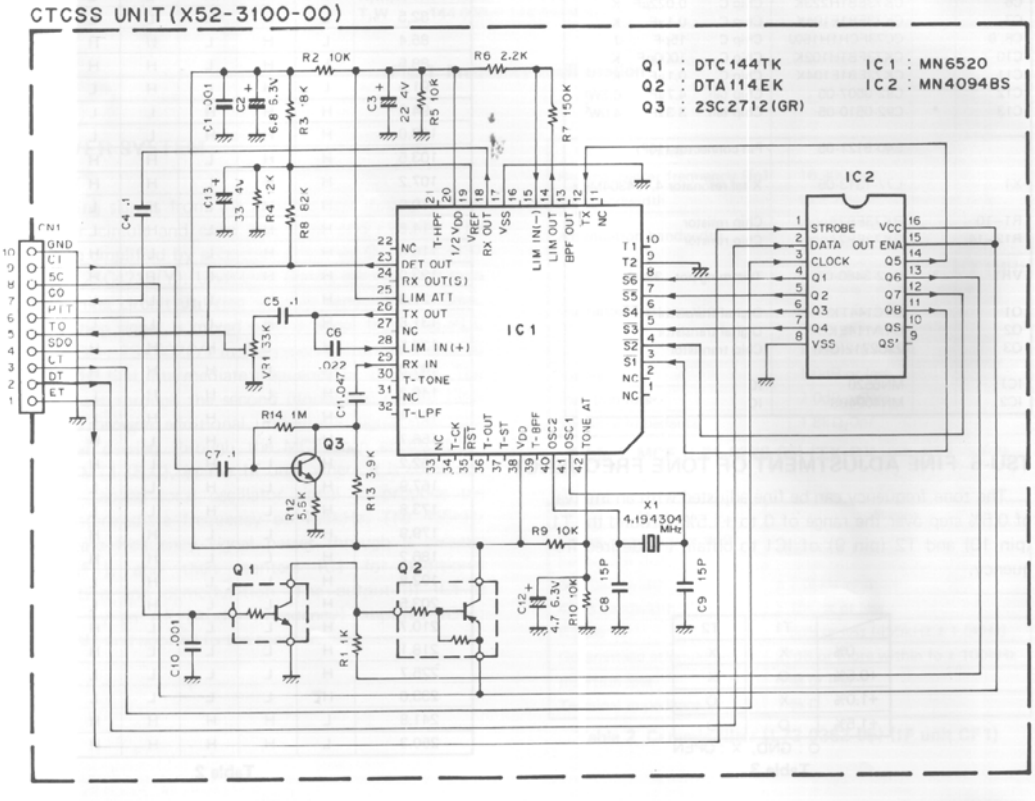
Foil side view



: Component side
: Foil side

TSU-6 CIRCUIT DIAGRAM

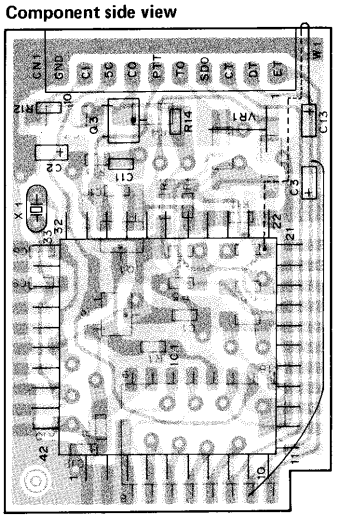
CTCSS UNIT(X52-3100-00)



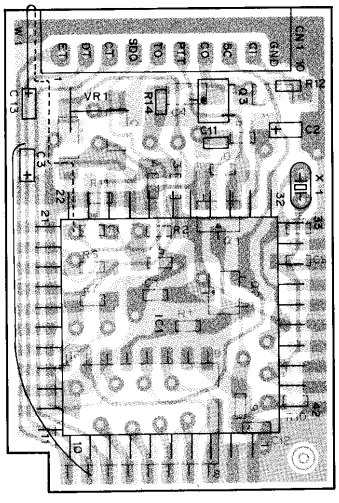
TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS

Component side view



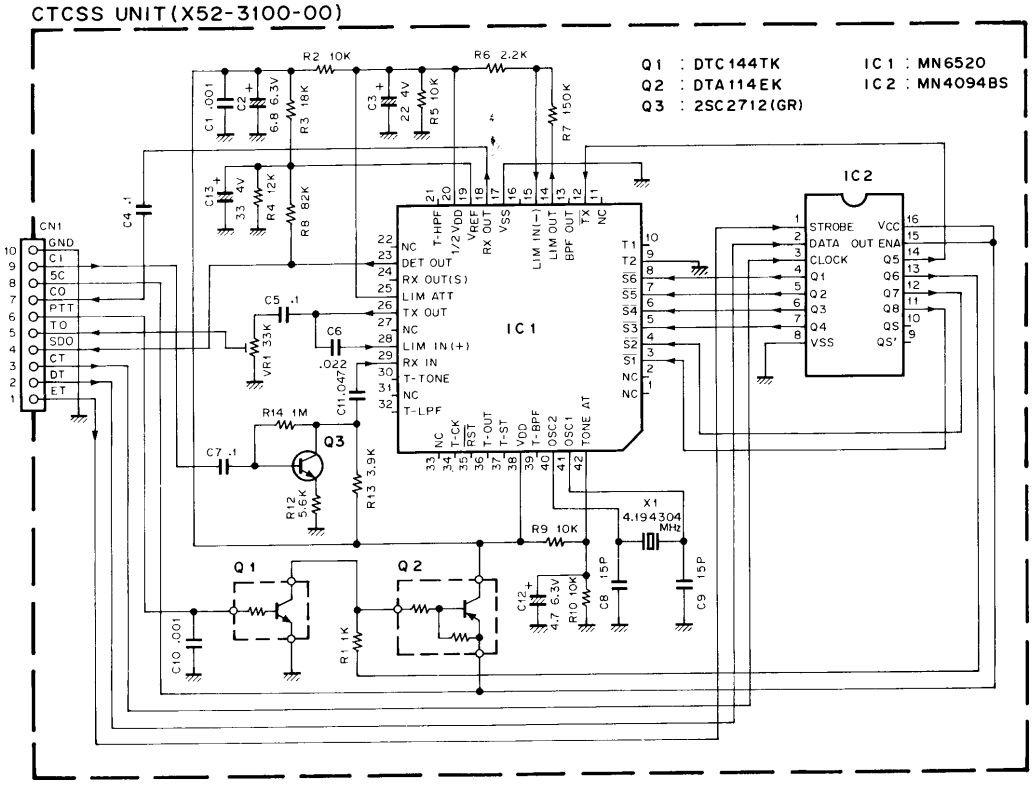
Foil side view



: Component side
: Foil side

TSU-6 CIRCUIT DIAGRAM

CTCSS UNIT(X52-3100-00)



MB-5 (MOBILE BRACKET)/WR-1 (WATERPROOF CASE)

MB-5 EXTERNAL VIEW

WR-1 EXTERNAL VIEW

MB-5 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	N99-0320-05	Screw set

ANTIQUES2
pagina 1

TH-25A/AT/E

SPECIFICATIONS

General

Frequency range	144.00MHz – 148.00MHz (TH-25A/AT) 144.00MHz – 146.00MHz (TH-25E)
Signal type	F3 (F3E)
Power supply voltage	DC 6V – 16V (DC IN jack)
Power consumption	At reception standby ; Approx. 55mA At battery power save ; Approx. 16mA At auto power off ; Approx. 6mA At transmission (5W) ; Less than 1.2A At transmission (0.5W) ; Less than 0.4A
Antenna impedance	50Ω
EXT. MIC impedance	2kΩ
Operating temperature	–20°C – +50°C
Dimensions	58 (68.5) W x 137.5 (152) H x 29.5 (34.5) D mm The numbers in the parenthesis include projections parts.
Weight	400g (including antenna and Ni-Cd batteries)

Transmitter section

Output power	Hi ; 5W, Low ; 0.5W
Modulation system	Reactance modulation
Max. frequency deviation	±5kHz
Unwanted reflection	Less than –60dB
Frequency tolerance	Less than $\pm 20 \times 10^{-6}$ ($-10^{\circ}C \sim +50^{\circ}C$)

Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st IF ; 16.3MHz 2nd IF ; 455kHz
Sensitivity	12dB SINAD ; 0.16μV
Squelch sensitivity	Less than 0.1μv
Selectivity	–6dB at more than 12kHz, –40dB at more than 28kHz
AF output	More than 200mW (8Ω load, distortion 10%)

Design and specifications subject to change without notice.

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